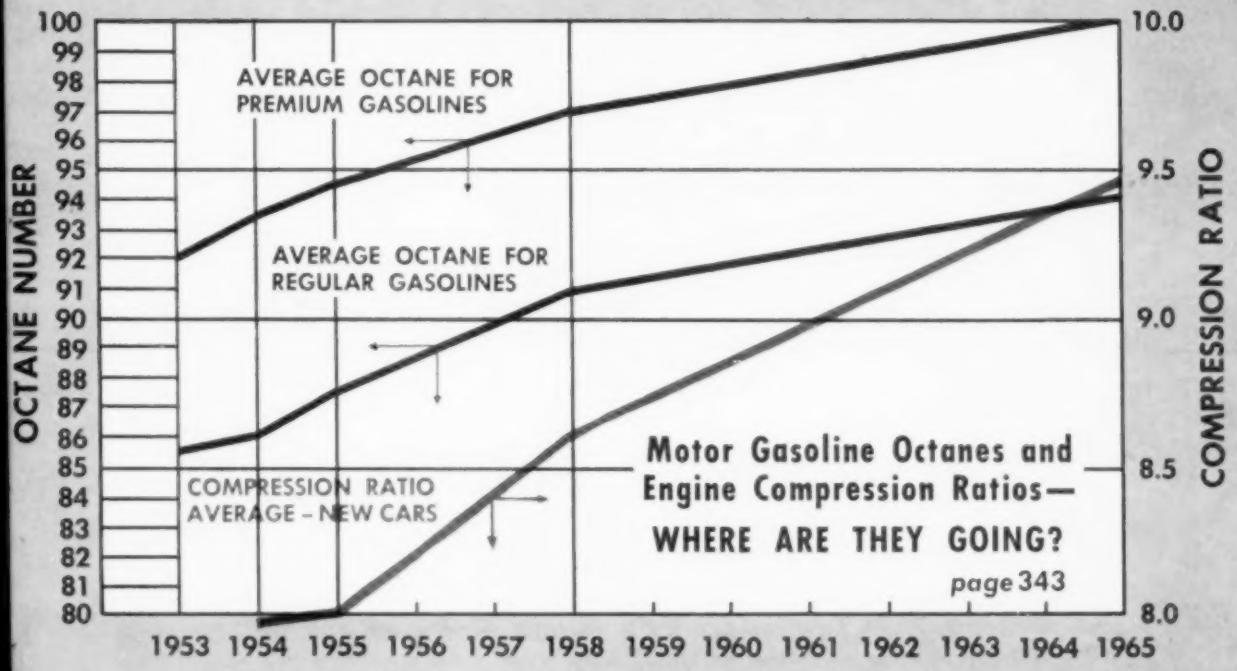
Petroleum Processing

INCLUDING PETROCHEMICAL SECTION MARCH, 1955



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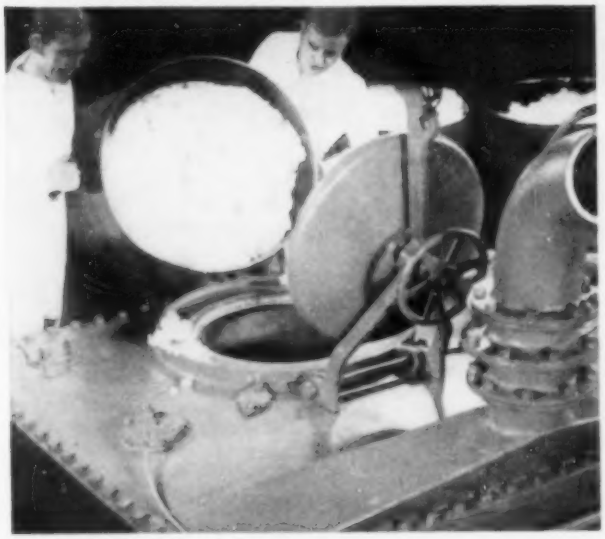

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PARATAC	Secondary Butyl Acetate	Decyl Alcohol
PETROHOL	Isopropyl Acetate	Denatured Ethyl Alcohol
Methyl Ethyl Ketone	Acetone	Tridecyl Alcohol
Dewaxing Aid	Methyl Ethyl Ketone	Dicyclopentadiene
Ethyl Ether	Dicyclopentadiene	Isoprene
Isopropyl Ether	Ethyl Ether	Butadiene
Reference Fuels	Isopropyl Ether	Ethyl Ether
	Naphthenic Acids	Isopropyl Ether
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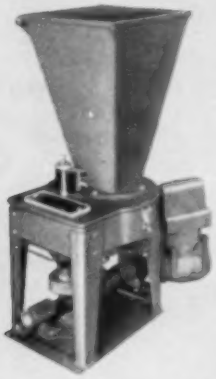
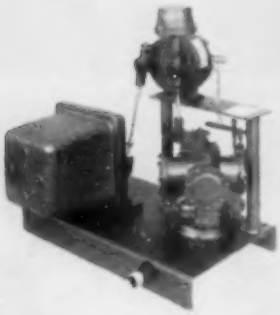
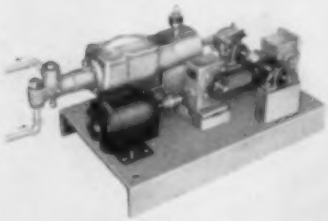


Solids-to-liquid stream feeders.



Flow responsive additive blenders.



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Petroleum Processing

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels, lubricants and chemicals.

March, 1955
Vol. 10, No. 3

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Petroleum Processing

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V. B. Guthrie—Just Relaxed, Not Retired

LAST month we celebrated quite an unusual event here in the editorial offices of PETROLEUM PROCESSING—the 40th Anniversary of Virgil B. Guthrie's joining the staff of our petroleum publications.

In February 1915 (the exact day of the month has been lost in the archives), Guth was hired as a reporter on *National Petroleum News*. He went on to become managing editor of the magazine in 1917, and was named editor of PETROLEUM PROCESSING when it was begun in 1946—with numerous intervening assignments.

Obviously, after 40 years on the job, Guth is no longer the gay young blade he was back in 1915. In fact, he'll celebrate his 70th birthday this June, and for some years past has been threatening to retire; last year he stepped aside as editor of PETROLEUM PROCESSING. Fortunately for us, however, he didn't retire—he just relaxed a bit. He has stayed on as Associate Editor—attending meetings, covering assignments, and in general being a most valuable consultant.

If you should ask Guth how he likes his new spot, he'll grin and quickly tell you "I'm having the most fun of my life, doing the things I like to do best—moving around, talking to people, finding out what's going on, and writing about it."

In fact, the lead story in this issue is one of Guth's pieces. He attended the annual meeting of the Society of Automotive Engineers in Detroit in January—and came back bubbling with enthusiasm about the story he picked up there on what is going to take place in the automotive fuels picture during the next few years.

One of his regular contributions to PETROLEUM PROCESSING is our monthly "Trends" section. Guth doesn't claim to be any whiz at figures, but he revels in digging into them and finding out what they mean. "Besides," he'll explain, "I've got a good secretary and she knows how to operate a calculator."

Although 25-year-men are not uncommon, it isn't every publication that can boast of a 40-year-man. We're not only proud to have V. B. Guthrie on our staff, but we're darn glad to have the benefit of the experience in petroleum those 40 years give us.

William F. Bland

Editor

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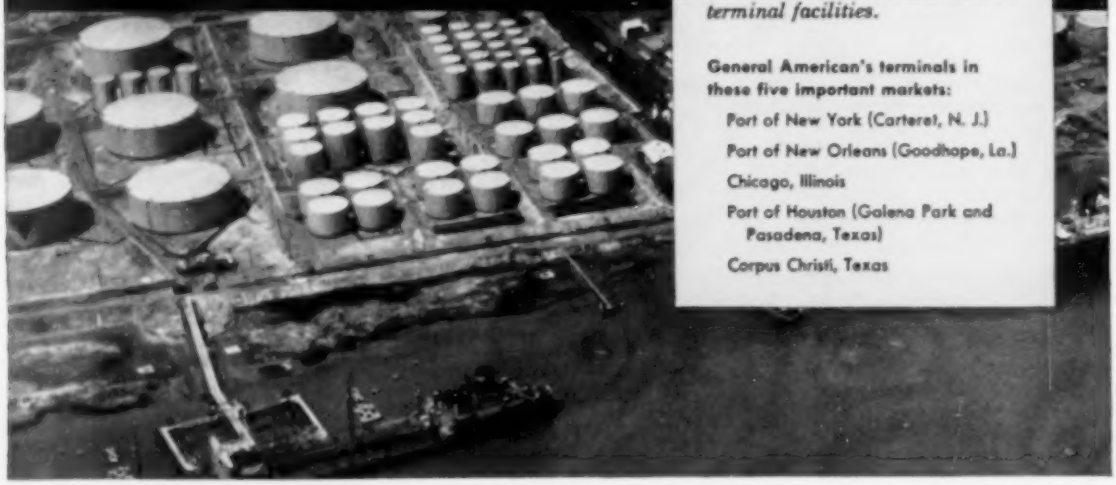
- Corpus Christi, Texas



What's Happening

in Refining

. . . **Sinclair Refining Co.** will spend $30,000,000 on modernization and improvement at Marcus Hook, Penna., and Houston, Tex.

At Marcus Hook, a $12,000,000 investment will be made in two new crude stills of 60,000 b/d capacity each, replacing completely the existing facilities, which had a design capacity totalling 100,000 b/d Project completion is scheduled for mid-1956.

At Houston, $16,500,000 is slated for a new 24,000 b/d catalytic reformer, the third Sinclair-designed unit using RD-150 platinum catalyst, a development of Sinclair and Baker & Co., Inc.

. . . **Frontier Refining Co.** plans a $1,500,000 expansion program at Cheyenne, Wyo., including a new 2000 b/d Platformer, 3000 b/d Unifiner, and a 2500 b/d crude still, raising throughput capacity to about 17,500 b/d. Steam plant capacity is to be increased from 60,000 to 300,000 lb/day., and storage facilities for 100,000 bbl. will be added. Completion is expected this summer.

. . . **Gulf Oil Corp.** has let contracts for a building program at Port Arthur, Texas, including a new 68,000 b/d Fluid catalytic cracking unit, a 100,000 b/d crude topping and vacuum unit, gas treating units to supply charge stock for ethylene production, amine treaters for sulfur production, a 300,000 lb/hr. steam boiler, and a 105,000 gpm cooling tower. No cost estimates were given.

Completion is planned for early 1956. M. W. Kellogg Co. has Fluid unit contract and Arthur G. McKee Co. has distillation unit contract.

. . . **Miami Oil & Refining Co.,** of Denver, Colo, has received rapid tax amortization on a $11,485,000 refinery to be built at West Palm Beach, Fla., of 15,000 b/d capacity.

. . . **Tide Water Associated Oil Co.** is reported to be in the engineering stages of a new fluid coker for its refinery in the San Francisco area. The company invested about $10,000,000 at the Avon plant in 1954, and plans another $20,000,000 in 1955.

. . . **New construction projects** approved for fast tax write-offs recently include the following:

Murmanill Corp., $851,000 for compression and dehydration facilities at natural gasoline plant at Fairbanks, Texas.

Standard Oil Co. (Ohio), $4,400,000 for a new 8600 b/d catalytic reforming unit, Cleveland O.

Pure Oil Co., $3,095,000 for a gathering system and natural gasoline plant to process 14,000,000 cfd of gas, Morgan County, Colo.

Esso Standard Oil Co., $2,120,000 for changing batch blending to continuous operation, at Bayway, N. J.

Ethyl Corp., $650,000 for research and development at Ferndale, Mich., and $450,000 at Baton Rouge, La.

California Oil Co., $125,000 for a 30,000 b/d crude oil desalting unit at Perth Amboy, N. J.

Phillips Petroleum Co., $488,000 for 10,000 b/d hydrogenation unit at Borger, Texas.

in Petrochemicals

. . . **Calumet Nitrogen Products Co.,** a new firm recently formed by Standard Oil Co. (Indiana) and Sinclair Refining Co., has awarded The Fluor Corp. a contract for design, engineering, and construction of a new plant to manufacture anhydrous ammonia and ammonium nitrate solutions at Hammond, Ind., from by-product hydrogen from the nearby refineries of both companies.

The project, scheduled for completion May, 1956, will include a 300 ton/day anhydrous ammonia plant, nitric acid unit to convert a portion of the ammonia, and the nitrate solutions plant. Ammonia will be made by the Fluor-Claude Process.

. . . **St. Paul Ammonia Products Co.** plans an anhydrous ammonia plant on site adjoining that at Pine Bend, 14 miles south of St. Paul Minn., on which Great Northern Oil Co. is building a refinery, which will supply charge stocks. It will have a capacity of 200 ton/day of the ammonia, nitrate fertilizer and nitrogen solutions, and is scheduled for operation in April, 1956.

. . . **Kentucky Hydrocarbon Co.,** a new subsidiary of Equitable Gas Co. will build a hydrocarbon recovery plant near Maytown, Ky., to process natural gas produced by Kentucky West Virginia Gas Co., another subsidiary, and Clinchfield Coal Corp., the gas to come through a 12-inch pipeline Kentucky West Virginia proposes building from Osborn Gap to Maytown.

Plant will be capable of producing about 10,000,000 cfd of products, which are to be sold under a long-term contract and sent by pipeline to Carbide & Carbon Chemicals Co. at So. Charleston and Institute, W. Va. Maytown is scheduled to start up about Jan. 1, 1957.

. . . **McGraw-Hydrocarbon,** a new joint venture of F. H. McGraw & Co. and Hydrocarbon Research, Inc., has been selected to negotiate a contract for the construction of a $25,000,000, urea fertilizer plant for the Republic of Korea. With an annual capacity of 80,000 tons, the plant will use fuel oil as the raw material source for ammonia. Completion is estimated at about mid-1957.

. . . **Sinclair Refining Co.,** as part of a broad modernization program, plans construction soon of new facilities for continuous manufacture of lube oil additives at Houston, Texas, replacing existing units

for batch type operation. A 30 ton/day sulfur recovery (from refinery gas and liquid streams) facility has recently been completed.

. . . **Dow Chemical Co. has** been granted permission to establish a wholly-owned Dutch subsidiary, to be known as Nederlandsche Dow Maatschappij N. V., in Rotterdam, Netherlands. Among products planned for the new firm are polystyrene plastic, glycols, and others now undergoing economic study.

in Foreign Operations

. . . **Indian government has approved** in principle plan to build Asia's first synthetic petroleum plant, to produce about 6000 b/d, or about 10% of the country's needs; including 4300 b/d of motor gasoline, diesel fuel, and lubes, and 1700 b/d of aviation gasoline.

. . . **Calvo Sotelo Co.,** government-owned, plans second refinery for Spanish mainland at Puertollano, Ciudad Real Province, where Calvo has a shale oil plant.

. . . **New refinery for Ireland?** Minister for Industry and Commerce of Eire has announced he has a letter from Esso Petroleum Co. of Ireland, Caltex Ireland Ltd., and Irish Shell, agreeing in principle to set up a company for the direction and operation of a jointly owned refinery in that country.

. . . **New 30,000 b/d refinery to be built in Greece,** near Athens, will be constructed by Hydrocarbon Mineralol GMBH. Duesseldorf, Germany, Greek prime minister Papagos has announced. No decision has yet been made as to the operator.

. . . **Caltex Petroleum Maatschappij** (Nederland NV) will install a 7000 b/d Platformer and a 4000 b/d diesel fuel desulfurization unit at Pernis, Rotterdam, this year.

in Markets and Prices

. . . **Winter weather was normal, but that was good.** The total of degree days for principal fuel consuming areas in the country came to exactly normal at mid-February. The point was it represented a 13.1% increase over a year ago. Thus—the best heating season in several years.

Demand was so great for both distillates and residuals that, even with crude runs hitting an all-time high (7,418,000 b/d in the week of Feb. 4), distillate and residual stocks together dropped 7,800,000 bbl. in the first week of February alone.

. . . **Prices reflected the strong demand.** Distillates were firm across the country, and heavy fuel was up at the Gulf. Evan gasoline was holding its own. There were scattered retail price wars in the East, and "discounts" of up to 0.75¢/gal reported at inland river terminals. But none of the flood of "distress" offerings occurred that late winter usually brings.

. . . **The first change in Bunker C cargo price** since domestic crude postings were hiked in June, 1953, happened when that price rose 10¢/bbl., to $1.95 at the Gulf. The Bunker C boost was largely due to a world-wide tightening of heavy oil supplies, and was sparked by a similar advance in Esso Export's Carribbean refinery price.

. . . **Natural gasoline and** LPG prices slid off 0.5¢ in seasonal declines. Manufacturers reported sales of Grade 26-70 natural gasoline at 5¢, FOB Group 3, and 4.5¢ Breckenridge. Lower contract prices reported for propane were Group 3, 3.5¢; Shreveport, 3.5¢; New Orleans, 3.625¢; Baton Rouge, 3.125¢; Houston, 3¢; New York, 8¢; and Philadelphia, 7.75¢.

in Transition

. . . **Indefinite shelving of idea for a refinery** in Minneapolis-St. Paul area was conceded by Shell Oil representative with announcement of plan by Shell and the Murphy Corp. to build a 450-mile, 16-in. pipe line to carry crude from Williston Basin to Platte and Western pipe lines, thence to existing refining centers in Wood River and Chicago, Ill.

. . . **Century Refining Co.,** Inc., a newly-organized Witchita, Kan., Company, is reported planning to reopen the 3000 b/d refinery closed last fall by Shallow Water Refining Co.

. . . **Negotiations are reported under way** for purchase of Wilshire Oil Co.'s Los Angeles refinery by Malco Refineries, Inc., Roswell, N. M.

Looking Ahead

. . . **Whither government shale oil activities?** Interior Dept. has not announced any decision to close Rifle, Colo., demonstration plant, but no money is earmarked in budget for its operation; and National Petroleum Council and a Bureau of Mines survey team have both recommended it be put in stand-by.

Meanwhile, five senators from Colo., Wyo., and Utah have introduced a resolution calling for its continuation at least another year, and the CIO has asked Congress to keep Rifle operating (see "Policies or Politics . . ." p. 440).

And at same time, Union Oil of Calif. has begun its $5,000,000 pilot program on commercial development of shale holdings near Rifle.

. . . **Military jet fuel demand going up.** Armed Services Petroleum Purchasing Agency has told National Petroleum Council that 1956 fiscal year requirements will be 7% above 1955, with jet fuel demand up approximately 20% and motor gasoline down 20%.

Tuesday night, September 28th: the Lummus initial operating team first fed oil into the crude unit of the 30,000 B/D refinery which Lummus designed, engineered and constructed for a major oil company at Mandan, North Dakota.

Wednesday night, September 29th: oil was fed into the fluid catalytic cracking unit.

Friday night, October 1st: the entire refinery was in operation at two-thirds capacity, with products going to storage.

Mandan refinery starts up in three days

The Mandan refinery was completed ahead of schedule, started up in record time, and has been operating ever since. It is an integrated plant including crude distillation section, fluid catalytic cracking unit, vapor recovery section, polymerization unit, treating and blending sections and desalter.

The owner has expressed pleasure and enthusiasm over the excellent time and performance records on the installation, made possible through painstaking engineering and construction efforts.

This adds one more to the over 700 efficiently engineered and constructed projects which Lummus has brought to completion over the past 50 years. May we work with you on your next project.

The Lummus Company, 385 Madison Avenue, New York 17, N. Y. **Engineering & Sales Offices:** New York, Houston, Montreal, London, Paris, The Hague. **Sales Offices:** Chicago, Caracas. **Heat Exchange: Plant:** Honesdale, Pa. **Fabricated Piping Plant:** East Chicago, Indiana.

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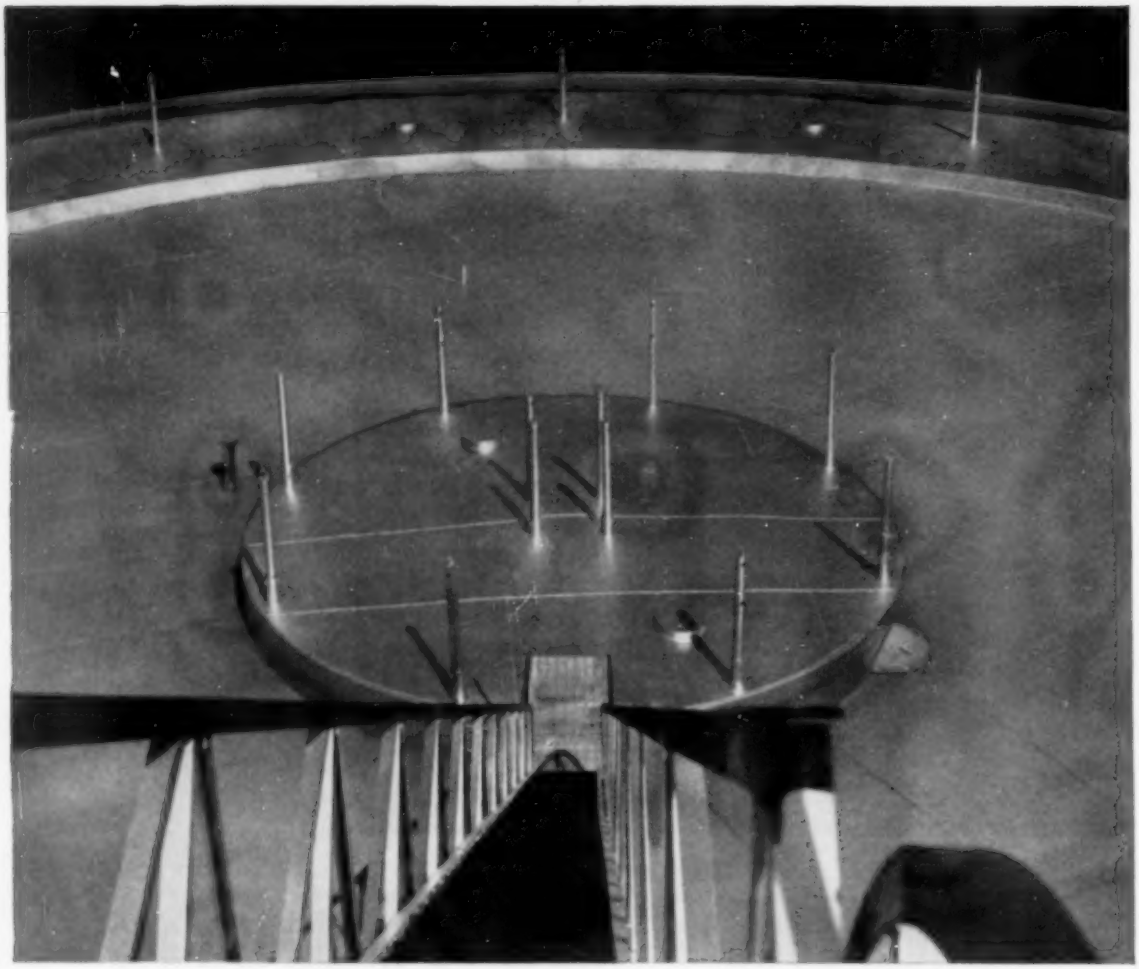
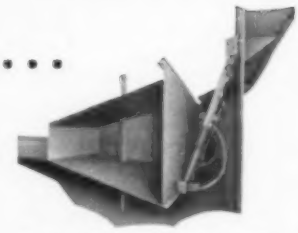


You are looking down . . .

into a Graver Center-Weighted "Floater." It's a well-built tank especially designed to conserve volatile vapors by means of Graver's own "Vapor-Stop" Seal—the improved seal which maintains firm closure between the floating roof and the shell. This patented Graver seal mechanism is an integral part of all Graver Floating Roof designs. It is flexible, yet firm—tight, yet responsive. It provides centering action for the roof and prevents the entrance of air and rain. From time to time you may expect similar technological improvements from Graver . . . where increasing emphasis will continue to be placed on research and development.



Graver's "Vapor-Stop" Seal!

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CASPER, WYO. • LOS ANGELES • FONTANA, CAL. • SAN FRANCISCO

(To obtain more data on advertised products see page 404)

Refining Research Being Spurred on By New Needs of Other Industries

IT IS well-known that the largest share of the research oil companies have done to date with new processes and products has been on behalf of their biggest single customer, the nation's automotive industry.

In the future, however, it seems likely they will find themselves called upon to do more work for other industries as well where technological progress is now gaining impetus. The net result will be a growth rather than a slackening off in the refining industry's research efforts.

This conclusion comes from a study of estimates of 1955 research and development expenditures made by A. L. Lyman, president, California Research Corp.[1] The author cites the widely publicized advances in the petroleum industry on new products for the new engine developments by the car makers.

"However," he states, "other industries that traditionally have spent little on research appear to be awakening to the benefits of applied research as a means to expand markets and earning power. The stone, clay and glass industry, textile and apparel, food and kindred products, paper and allied products, and the primary and fabricated metals industries, each of which participates to the extent of less than 2% in the total research effort, all now indicate increasing activity and interest . . . Many companies, large and small, show increases in research and development expenditures over 1952 of as much as 50 to 100%, or higher."

A potential chain reaction—"It is well recognized that research and development create new fields for further research," he went on. "If ever a phenomenon or process deserves the definition of a potential chain reaction, it is the mechanism of industrial technology fostered by research and development in the sciences and engineering. The interrelation and interdependence among the industries and the sciences are becoming increasingly apparent as new frontiers are opened in one sector that lead to developments in another."

This stimulus to research in refining may improve its own standing in this field. The relative expenditures for research and the number of personnel employed, among major industries, were studied in the Lyman report, based on a study made in 1953 by the Secretary of Defense. The study was projected through 1955 by means of a limited survey of some 120 industrial firms. The accompanying table shows the relationship of various industries in expenditures in 1951, and in personnel employed in 1952. It includes both industry and government financed research. This breakdown for industries is not available for the succeeding years.

A Continuous rise for all industry is forecast, however, in research and development expenditures. For industry-financed work, it will go from about $1,400,000,000 in 1952 to over $1,800,000,000 this year, an increase of nearly 30%. Including government-financed research, the total is estimated to rise from $2,450,000,000 in 1953 to $2,700,000,000 for this year. Employment figures increased from 114,000 in 1953 to 126,000 in 1955.

The ratio of all engineers and scientists to those in research only—for the companies surveyed—remained at about 3.5:1 during the years studied. Commenting on this, Lyman's report states, "Apparently, an increasing research and development force carries with it an increasing need for engineers and scientists in production and operation . . . The implication then is that industry's total demand for engineers and scientists in all its activities can be expected to be reasonably proportional to its increasing research and development program."

The findings of the Lyman report, together with the continually growing need for finding more engineering talent for the industry, is expected to stimulate the petroleum processing companies to find the means for relieving their professional research staffs from routine work to the greatest possible extent. They would thus be able to add to the technical potential of the staffs and be ready for the opportunities which the future seems to hold in research. V. B. G.

(1) "Estimated Volume of Research and Development Expenditures by Industry in 1955," A. L. Lyman, California Research Corp., presented at a Conference on Scientific Manpower, Berkeley, Calif., December 29, 1954.

Industrys' Share of National Research Activities

(Research costs for 1951 and personnel for 1952)

Industry	Cost, $	Percent	Personnel	Percent
Electrical machinery	508,300,000	22.1	21,480	18.2
Chemical and allied	257,600,000	11.2	17,225	14.6
Aircraft	478,400,000	20.8	24,900	21.1
Petroleum refining	112,700,000	4.9	6,135	5.2
Machinery (excl. electric)	121,900,000	5.3	7,315	6.2
Prof & Sci. instruments	108,100,000	4.7	7,080	6.0
Motor vehicles, equipt.	248,400,000	10.8	3,775	3.2
Others	464,600,000	20.2	30,090	25.5
Totals	$2,300,000,000	100.0	118,000	100.0

Modified Fractional Crystallization Promises Better Xylene Separation

A NEW processing technique developed for the separation of para from meta xylene may greatly increase effective plant capacity without a corresponding increase in capital investment. A relatively simple alteration for improving the efficiency of conventional fractional crystallization, it beats the problem of formations of eutectic mixtures.

The method can also be used to increase recoveries of the meta xylene and simultaneously reduce the volume of meta and para mixture which must be disposed of—usually in motor or aviation gasoline or in solvents.

This does not mean there will be a sudden upsurge in production of either of the isomers. Pure meta

xylene is not yet in wide commercial use, and the market for the para isomer has been relatively static for some time, reflecting conditions in the textile field. In fact, some plants have not been producing the para at capacity for a considerable length of time and others have shelved expansion plans, at least temporarily.

In the principal process now used, fractional crystallization of para from the para-meta mixture, recoveries have been limited by the formation of a eutectic para-meta mixture even though a few "know how" tricks have helped boost net production.

The new wrinkle, a development by California Research Corp. (subsidiary of Standard Oil Co. of Calif.), adds carbon tetrachloride to the meta-para mixture before it is chilled.[1] Operating at a considerably lower temperature than simple fractional crystallization, a eutectic is formed with the para isomer which carries with it most of the para upon filtration from the mother liquor. The para then is stripped from the carbon tetrachloride.

Then, if the mother liquor also is stripped of its carbon tetrachloride and again frozen, the remaining para xylene will form the usual eutectic with some of the meta xylene and can be filtered out, leaving pure meta. This cannot be done with the present commercial process.

Yields are very attractive, it is said. Of the 18% para xylene present in a typical catalytic reformer xylenes cut, the mixture will still contain 13% para after conventional fractional crystallization, and only 2% after separation with carbon tetrachloride. And, about 92% of the meta xylene can be recovered by re-feezing the remainig mother liquor, leaving about 8% of the original mixture to be disposed of in gasoline or solvents. This compares with around 94% of the mixture where conventional processes are used.

Existing plants can use the new process modification, it now appears, by adding more refrigeration capacity to reach the lower temperature required in the freezing of the para xylene-carbon tetrachloride eutectic, and by adding stripping columns to permit recovery of the carbon tetrachloride.

Reported requirements of carbon tetrachloride are one mol per mol of para xylene, plus 1.2 mols per mol of meta xylene (to prevent meta crystallization). The latter will be reduced if other aromatics and non-aromatics are present in the charge stock.

—D.P.T.

(1) *Chemical Week*, Jan. 15, 1955, pp. 78-79.

'Superalloys' Ready for Tomorrow's Petroleum Processing Equipment

AVERAGE temperatures for industrial processes are increasing rapidly. Only a few years ago they were as low as 350 to 500° F. Today they are 500 to 700° F. and still climbing. Many petroleum processes require temperatures even higher than the industrial average. Catalytic cracking and reforming, for example, operate as high as 950° F. or more. Other newer processes on the way may require still higher operating temperatures.

Currently used ferritic alloys are adequate for most present-day applications, possessing useful strength up to about 1050° F. Alloys such as 18-8 chrome-moly steel are used satisfactorily at temperatures of 1100° F. However, the austenitic steels of today, combined with well-designed cooling systems, may be applied to even more rigorous conditions.

Have potential benefits been sacrificed in petroleum processes by limitation to conventional alloys? The new "superalloys," ranging in yield strength from 70,000 to 90,000 psi. and in tensile from 100,000 to 120,000 psi, offer great design advantages and savings for high-temperature, high-pressure equipment. However, they cannot be used economically today because of "design code" restrictions in the stress allowances not permitting full potentialities to be realized.[1]

Several attacks have been made on the problem of high-temperature construction materials.

Work-hardened superalloys, on an austenitic base, have shown good properties in the 1100 to 1300° F. range, but the work-hardening requirement restricts their use to relatively small or simple items.

Precipitation-hardened superalloys—made by a process similar to that used for aluminum alloys—appear more attractive than the work-hardened alloys. They may be cast, allowing a wide range in sizes and shapes, and have useful properties in the range from 1350 to 1700° F.

Metal-ceramic hybrids, called ceramets, appear promising for limited high temperature operations. Ceramets are formed by crossing refractory materials —such as borides, carbides, oxides, silicides, etc.— with a metallic binder consisting of any of many different metals or alloys.

Primary disadvantages of ceramets are that they are usually not machinable except by diamond grinding wheels—therefore they must be formed accurately into their desired final shapes—and they possess a tendency toward brittleness. Encouraging results have been obtained recently in producing ceramets showing a creep-rupture ductility approaching that of some superalloys.

Some molybdenum alloys have excellent creep-rupture strengths in the 1700 to 2000° F. range, even exceeding that of the present austenitic steels at temperatures as much as 500° F. lower. However, a lack of oxidation resistance limits the use of molybdenum alloys. When heated in air, the metal—not the alloy—starts oxidation as low as 750° F. and disappears rapidly in the form of a white smoke at 1300° F.

Although much progress has been made in the search for oxidation-resistant alloys having high strength at high temperatures, a real challenge remains in the fields of metals research and metals application to equipment design. —R. L. D.

(1) "More Economic Pressure Vessels," W. C. Uhl, PETROLEUM PROCESSING, May, 1954, p. 711.

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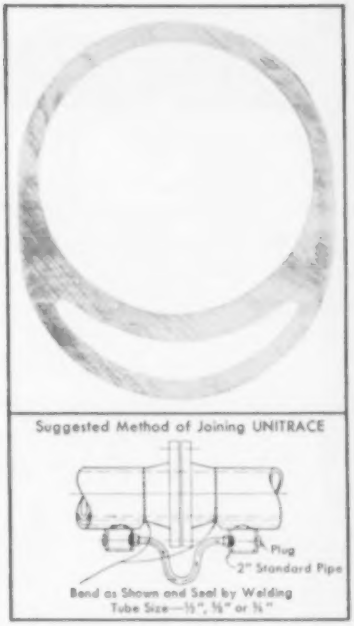

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Letters

Statistics—Again!

To THE EDITOR: I was glad to know that Mr. E. J. Walichowski, who is apparently a statistician, agrees that "statistics is not a cure-all" ["Letters to the Editor," December, 1954, pp. 1830-1831]. Therefore, it must be handled with care ["Editorials," August, 1954, p. 1292]. The inherent weakness of statistics which cannot be remedied by using arithmetic, square root or even cube root and higher power averages is that it arrives at conclusions not by inductive or deductive methods but by analogy, the weakest type of reasoning. This shows that we use statistics only when we are at our wits ends and this happens with all of us when we try to penetrate the unknown.

V. A. KALICHEVSKY

820 Twentieth Street
Beaumont, Texas

Forecast Suggestions

To THE EDITOR: . . . In your 1955 forecast ["What 1955 Will Bring Refiners," December, 1954, pp. 1867-71] . . . A clearer picture of the potential effects of surplus refining capacity would appear if you included a history of the Jan. 1 refining capacity and the annual runs-to-stills for a period of 25 years past. It would show that the current surplus is not abnormal and should not be feared.

Persons who do so are employing a poor mental yardstick. There are too many people who think the country should run at maximum capacity at all times. I am not one of these. I do not even like to drive my car as fast as it will go.

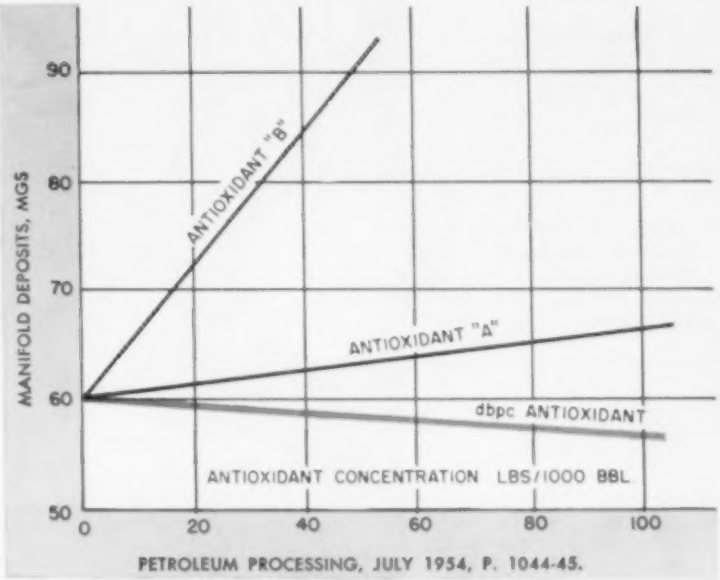
A short statement on the general business outlook should be included so that the professional reader will know within what framework your demand forecasts are prepared. This can be quite brief but should include a few basic numbers such as construction expenditures and the like. . . . The form of your presentation is particularly attractive and easy to grasp.

M. E. DICE

Manager
Economics Dept.
General Petroleum Corp.
Los Angeles, Calif.

• *Thank you indeed, reader Dice. The many helpful suggestions you and others have made (Letters, Jan., 1955, p. 15) will assist in guiding us on the 1956 forecast.*

Engine Tests prove . . .



PETROLEUM PROCESSING, JULY 1954, P. 1044-45.

dbpc Antioxidant contributes NO manifold deposits

Three antioxidants were tested in a blend containing 60% catalytic cracked and 40% thermal cracked gasolines. The antioxidants tested were **dbpc**® inhibitor* and antioxidants "A" and "B" — other well-known commercial gasoline gum inhibitors.

The manifold test unit consisted of a specially-designed manifold attached to a single-cylinder, air-cooled engine, with provisions for control of fuel rate and temperature. The air-fuel mixture from the carburetor entered the manifold which was heated by two 500-watt, pancake electric heaters attached to the manifold exterior. Manifold temperature averaged 255° F.

dbpc (indicated in red) did not contribute to manifold deposits. Actually, it tended to *reduce* deposits. Antioxidants "A" and "B" however, *increased* manifold deposits.

dbpc is safe and easy to handle. It is economical, highly soluble in gasoline and is inert to extraction by caustic and water and the commonly used pipe corrosion inhibitor.

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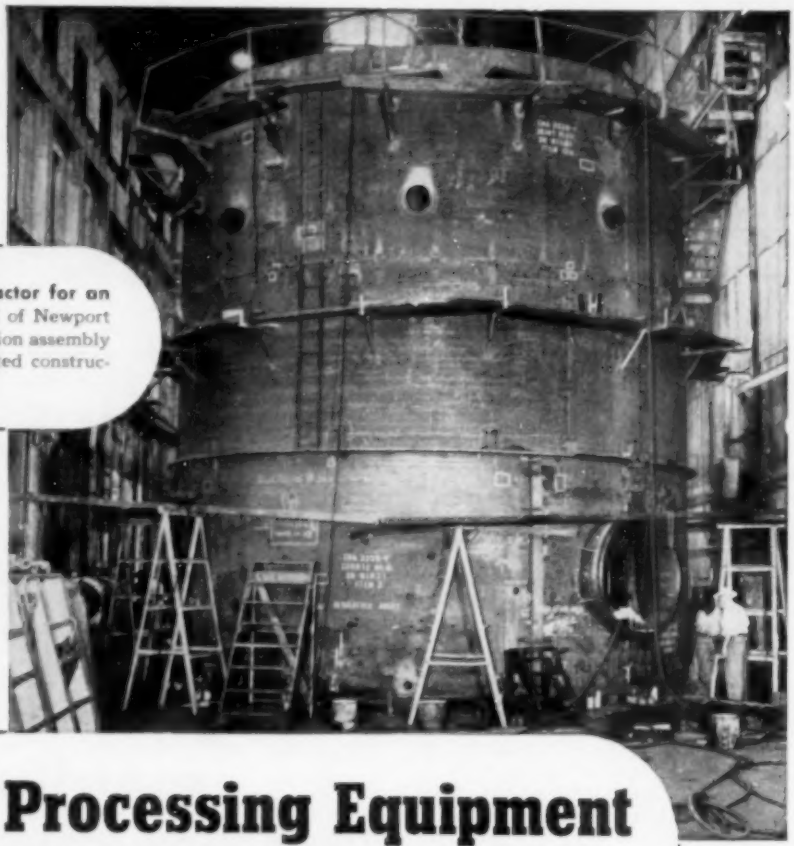

Course number four of a reactor for an overseas oil refinery. Typical of Newport News plant methods, the precision assembly of this unit in the shop expedited construction of the reactor in the field.

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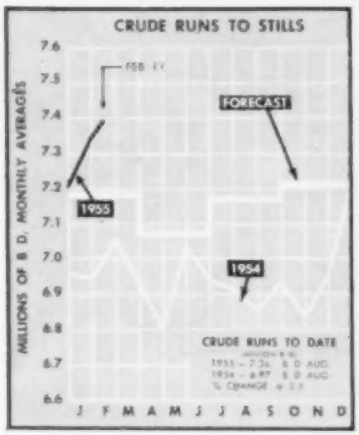
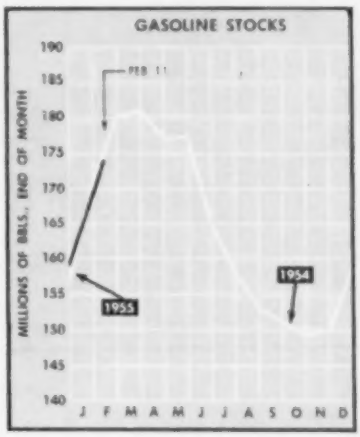
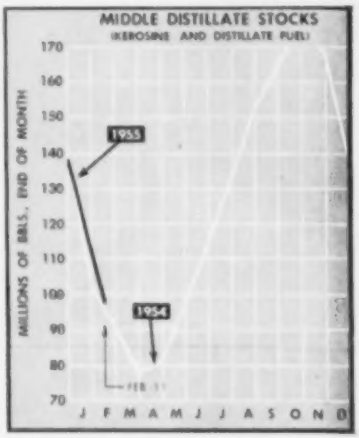






Runs High for 1st Quarter Needs

REFINERY operations for the first six weeks of the year were at a rate about 5% greater than the same period in 1954. Heavy demand for distillate fuels and gasoline in early February held off the start of the seasonal decline in overall product demand.

Crude runs to stills of over 7,350,000 b/d avg., the rate since Jan. 1, will be too great when the current shipments of distillate fuels from refineries drops. The forecast of first quarter runs is about 7,200,000 b/d avg.

Refiners' stocks for the four major products (gasoline, kerosine, distillate and residual fuels) were about 318,500,000 bbls. on Feb. 11, some 6,000,000 bbls. greater than last year. On Jan. 31 these inventories were about 9,000,000 bbls. more than a year ago.

OUTLOOK: Runs to stills likely to remain high, but strong gasoline demand will hold stocks near last year's levels.

Larger seasonal requirements for distillate fuels for heating oils are due both to the colder winter and more burners in service. Indicated refinery shipments in December and January were almost 6.4% larger than the year before, and indicated demand in early February was even higher. From Nov. 30 to Feb. 11, refiners' distillate stocks were reduced about 56,750,000 bbls., as against 58,300,000 bbls. a year ago.

Refiners have made progress this winter in adjusting their product yields to give a higher output of distillate fuels. In November (latest month for which official figures are available) the average yield for the U.S. was 22.9% of crude run, as compared with 20.7% in November, 1953.

Gasoline demand at refineries in January was about 7% larger than the year before, and indicated demand in early February was around 4% greater. Total U.S. stocks Feb. 11, over 174,000,000 bbls., were about the same as the year before. East of California stocks this year, 153,650,000 bbls., were about 2,000,000 bbls. larger. The forecast of adequate inventories March 31 is 180,000,000 bbls.

Residual fuel oil stocks both in California and the rest of the U.S., have been gradually reduced for several months. These reductions are likely to continue, reflecting the demand for this product from abroad, Europe principally, at U.S. refineries.

FEBRUARY KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Feb. 1955*	Jan. 1955	Feb. 1954
CRUDE OIL			
U. S. Production	6.720	6.665	6.379
Imports	.825	.720	.621
U. S. Stocks	260.925	259.828	266.918
Runs to Stills	7.397	7.343	7.068
GASOLINE			
Refinery Output	3.549	3.534	3.365
Refinery Demand	3.322	3.198	3.182
Primary Stocks	174.203	170.349	179.950
MIDDLE DISTILLATES			
Refinery Output	2.171	2.136	1.957
Refinery Demand	3.298	3.069	2.417
Primary Stocks	97.596	109.982	90.573
RESIDUALS			
Refinery Output	1.227	1.218	1.241
Imports	.492	.555	.483
Total Supply	1.719	1.773	1.724
Refinery Demand	1.857	1.875	1.753
Primary Stocks	46.689	48.208	47.119

*Through Feb. 11

PRODUCT AND CRUDE PRICES

Products—¢ gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	Feb. 1955*	Jan. 1955	Feb. 1954
Gasoline	11.29	11.36	11.92
Distillate Fuel Oil	9.32	9.22	9.20
Kerosine	10.71	10.71	10.60
Residuals	4.21	4.18	4.17
Above 4 Products	8.84	8.85	9.12
Lube Oils	16.52	16.48	17.07
Crude	2.82	2.81	2.82

REFINERY YIELDS

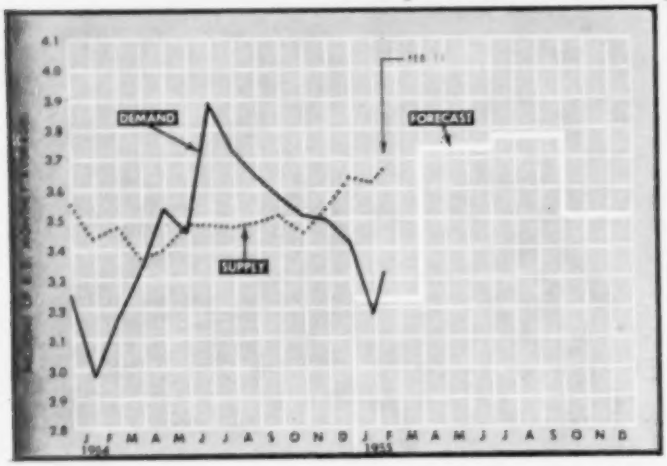
% on Crude Runs to Stills

	Feb. 1955*	Jan. 1955	Feb. 1954
Gasoline	43.4	43.6	42.8
Kerosine	5.1	5.4	5.8
Distillate	24.2	23.7	21.7
Residuals	16.6	16.6	17.5

*Through Feb. 11

SOURCE OF DATA (except prices): Dec., Jan. and Feb., API weekly reports; earlier months, Bureau of Mines

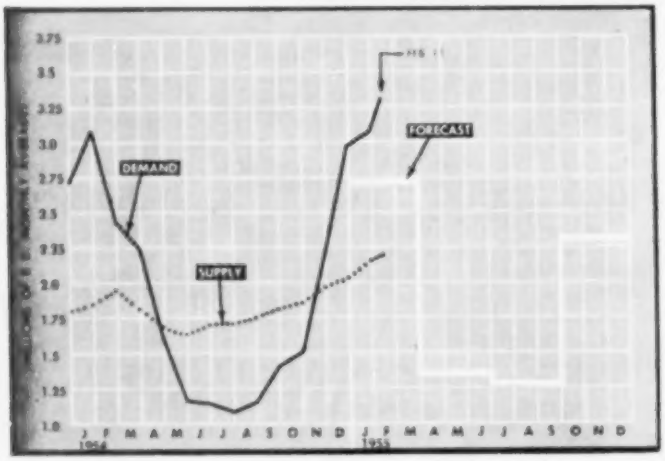
Pick Up in Motor Fuel Shipments



MOTOR FUELS

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
Jan. '55	3.204	.417	3.621
Jan. '54	3.043	.388	3.431
Change	+.161	+.029	+.190
% Change	+5.2	+7.5	+5.5
DEMAND (including Exports) (Millions of b/d)			
Jan. '55			3.198
Jan. '54			2.985
Change			+.213
% Change			+7.1
TOTAL SUPPLY (Millions of bbls.)			
12 Mos. '54	1,115.638	154.787	1,270.425
12 Mos. '53	1,122.661	144.264	1,266.925
Change	—7.023	+10.523	+3.500
% Change	—0.6	+7.3	+0.3
TOTAL DEMAND (including Exports) (Millions of bbls.)			
12 Mos. '54			1,271.925
12 Mos. '53			1,244.249
Change			+27.676
% Change			+2.2

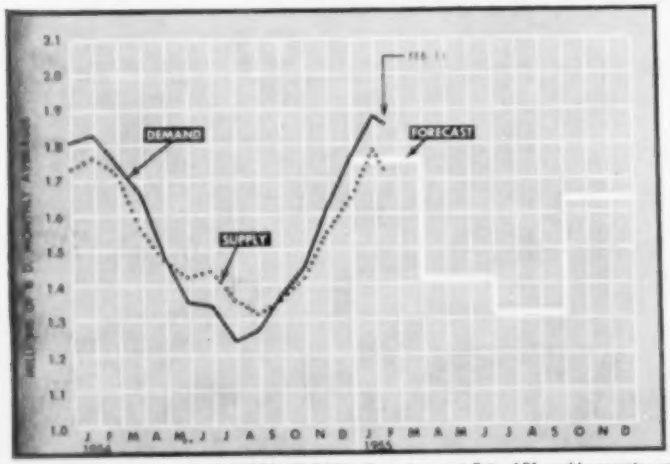
Cold Snap Boosts Distillate Demand



MIDDLE DISTILLATES

	Kerosine	Dist. Fuel Oil	Total
PRODUCTION (Millions of b/d)			
Jan. '55	.393	1.743	2.136
Jan. '54	.390	1.467	1.857
Change	+.003	+.276	+.279
% Change	+0.8	+18.8	+15.0
DEMAND (including Exports) (Millions of b/d)			
Jan. '55	.565	2.504	3.069
Jan. '54	.605	2.470	3.075
Change	—.040	+.034	—.006
% Change	—6.6	+1.4	—0.2
TOTAL PRODUCTION (Millions of bbls.)			
12 Mos. '54	122.176	541.744	663.920
12 Mos. '53	123.200	528.111	651.311
Change	—1.024	+13.633	+12.609
% Change	—0.8	+2.6	+1.9
TOTAL DEMAND (including Exports) (Millions of bbls.)			
12 Mos. '54	122.812	548.600	671.412
12 Mos. '53	121.732	521.379	643.111
Change	+1.080	+27.221	+28.301
% Change	+0.9	+5.2	+4.4

Demand Holds Up for Residual Fuels



RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
Jan. '55	1.218	.555	1.773
Jan. '54	1.271	.490	1.761
Change	—.053	+.065	+.12
% Change	—4.2	+13.3	+0.6
DEMAND (including Exports) (Millions of b/d)			
Jan. '55			1.875
Jan. '54			1.835
Change			+.040
% Change			+2.2
TOTAL SUPPLY (Millions of bbls.)			
12 Mos. '54	415.241	132.671	547.912
12 Mos. '53	449.979	136.209	586.188
Change	—34.738	—3.538	—38.276
% Change	—7.7	—2.6	—6.5
TOTAL DEMAND (including Exports) (Millions of bbls.)			
12 Mos. '54			551.335
12 Mos. '53			591.141
Change			—39.806
% Change			—6.7

SOURCE OF DATA: Dec., Jan. and Feb., API weekly reports; earlier months, Bureau of Mines

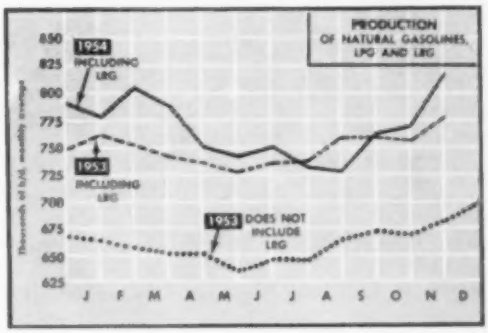
RUNS TO STILLS and DISTRIBUTION OF PRIMARY STOCKS BY U.S. REFINERY DISTRICTS

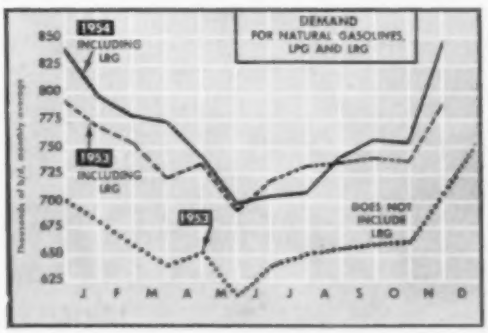
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Feb. 11, 1955	Feb. 12, 1954	Change	% Change	GASOLINE STOCKS (Millions of bbls., on date shown) Feb. 11, 1955	Feb. 12, 1954	Change	% Change	RESIDUAL STOCKS (Millions of bbls., on date shown) Feb. 11, 1955	Feb. 12, 1954	Change	% Change
East Coast	1.090	1.020	+.070	+ 6.9	35.003	35.096	— .093	— 0.3	7.967	9.248	—1.281	—13.9
Gulf Coast	2.413	2.237	+.176	+ 7.9	35.503	35.257	+ .246	+ 0.7	5.585	7.036	—1.451	—20.6
Total Coastal	3.503	3.257	+.246	+ 7.6	70.506	70.353	+ .153	+ 0.2	13.552	16.284	—2.732	—16.8
Appalachian	.203	.211	—.008	— 3.8	7.286	6.307	+ .979	+16.0	.624	.880	— .256	—29.1
Ind.-Ill.-Ky.	2.376	1.343	+.033	+ 2.5	39.081	37.567	+1.514	+ 4.0	2.886	4.263	—1.377	—32.3
Okla.-Kans.-Mo.	.659	.592	+.067	+11.3	19.136	18.740	+ .604	+ 3.2	1.201	1.058	+ .143	+13.5
Other Inlands	.622	.595	+.027	+ 4.5	18.642	18.821	— .179	— 1.0	2.291	2.121	+ .170	+ 8.0
Total Inland	2.860	2.741	+.119	+ 4.3	83.145	81.435	+1.710	+ 2.1	7.002	8.322	—1.320	—15.9
Total East of Calif.	6.363	5.998	+.365	+ 6.1	153.651	151.788	+1.863	+ 1.2	20.554	24.606	—4.052	—16.5
California	1.021	1.032	—.011	— 1.1	20.552	22.229	—1.677	— 7.5	26.135	21.315	+4.820	+22.6
Total U.S.	7.384	7.030	+.354	+ 5.0	174.203	174.017	+ .186	+ 0.1	46.689	45.921	+ .768	+ 1.7

District	DISTILLATE FUEL O'L STOCKS (Millions of bbls., on date shown) Feb. 11, 1955	Feb. 12, 1954	Change	% Change	KEROSINE STOCKS (Millions of bbls., on date shown) Feb. 11, 1955	Feb. 12, 1954	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbls., on date shown) Feb. 11, 1955	Feb. 12, 1954	Change	% Change
East Coast	26.330	26.696	— .366	— 1.4	8.434	8.481	— .047	— 0.6	34.764	35.177	— .413	— 1.2
Gulf Coast	10.968	10.446	+ .522	+ 5.0	3.905	3.079	+ .826	+26.8	14.873	13.525	+1.348	+10.0
Total Coastal	37.298	37.142	+ .156	+ 0.4	12.339	11.560	+ .779	+ 6.7	49.637	48.702	+ .935	+ 1.9
Appalachian	2.257	1.603	+ .654	+40.8	.804	.942	— .138	—14.6	3.061	2.545	+ .516	+20.3
Ind.-Ill.-Ky.	12.861	11.725	+1.136	+ 9.7	5.650	4.814	+ .836	+17.4	18.511	16.539	+1.972	+11.9
Okla.-Kans.-Mo.	8.708	7.135	+1.573	+22.0	1.334	1.041	+ .293	+28.1	10.042	8.176	+1.866	+22.8
Other Inland	4.553	4.131	+ .422	+10.2	.947	.890	+ .057	+ 6.4	5.500	5.021	+ .479	+ 9.5
Total Inland	28.379	24.594	+3.785	+15.4	8.735	7.687	+1.048	+13.6	37.114	32.281	+4.833	+15.0
Total East of Calif.	65.677	61.736	+3.941	+ 6.4	21.074	19.247	+1.827	+ 9.5	86.751	80.983	+5.768	+ 7.1
California	10.481	11.521	—1.040	— 9.0	.364	.407	— .043	—10.6	10.845	11.928	—1.083	— 9.1
Total U.S.	76.158	73.257	+2.901	+ 4.0	21.438	19.654	+1.784	+ 9.1	97.596	92.911	+4.685	+ 5.0

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS

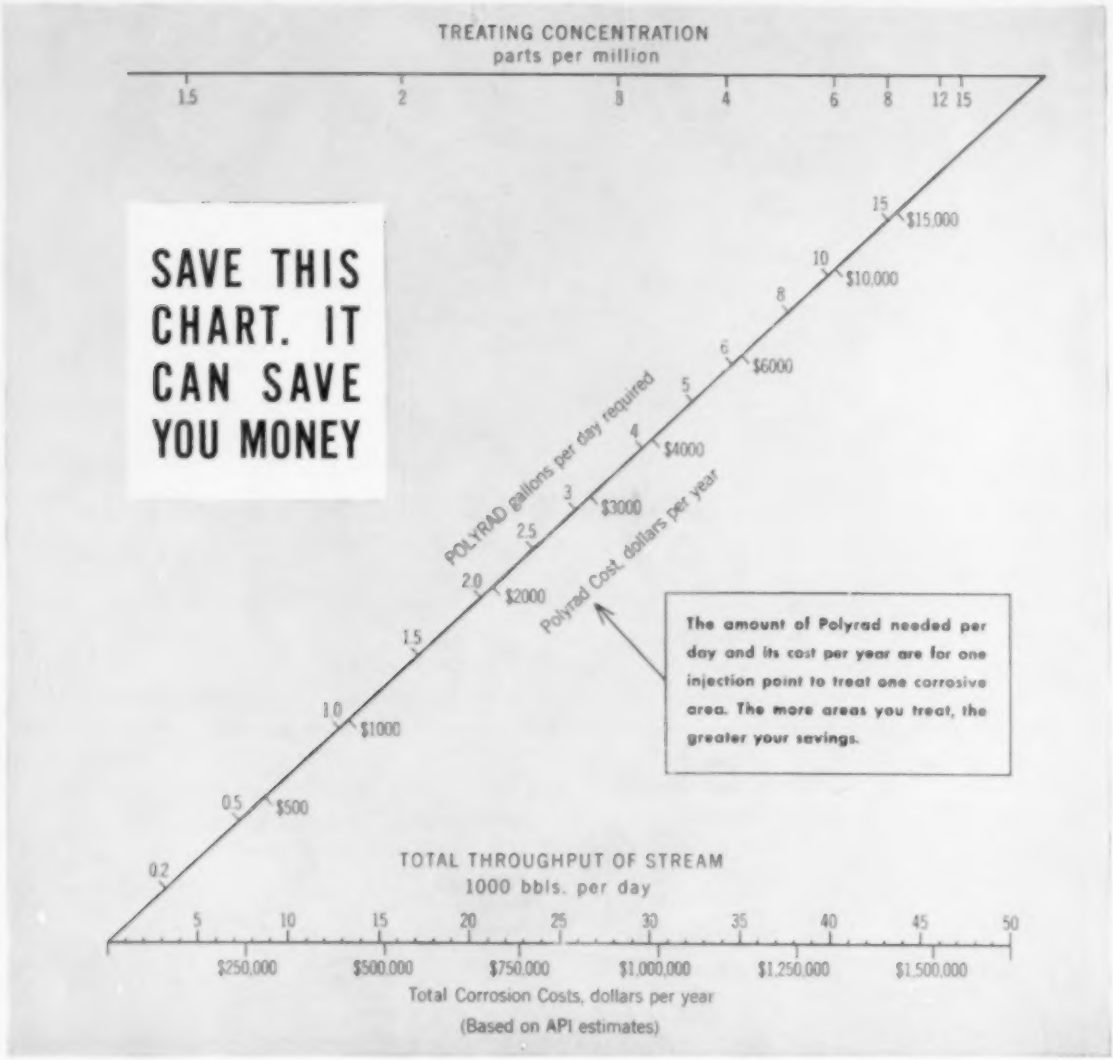
(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	Nov. 1954	Oct. 1954	Nov. 1953
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	360	332	326
Natural Gasoline and Isopentane	274	274	258
Condensate	23	24	28
Finished Gasoline, Naphtha and other	65	62	71
Total Natural Gasoline and Cycling Plant Production	722	692	683
Liquefied Refinery Gases	97	80	93
Total Marketable Gas Liquids	819	772	776
Lease Condensate	102	96	93
Total Natural Gas Liquids	921	868	869
CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	473	394	415
Natural Gasoline, Isorentane and Other	373	358	371
Total Current Demand	846	752	786

CUMULATIVE PRODUCTION (1000 bbls.)	Nov. 1954	Nov. 1953
LPG and LRG	138,291	133,012
Natural Gasoline, Isopentane and Other	117,977	117,665
Total Marketable Gas Liquids	256,268	250,677
CUMULATIVE DEMAND (1000 bbls.)		
LPG and LRG	132,981	127,777
Natural Gasoline, Isopentane and Other	118,384	118,359
Total Cumulative Demand	251,365	246,136

STOCKS (1000 bbls., end of month)	Nov. 1954	Oct. 1954	Nov. 1953
LPG and LRG	9,787	10,271	5,821
Natural Gasoline, Isopentane and Other	4,481	4,809	5,082
Total Stocks	14,268	15,080	10,903

HOW POLYRAD CUTS CORROSION COST



With this chart you can quickly get an idea of how much you can save in your refinery—at so little cost—with Polyrad corrosion inhibitor. Just connect points at the top and bottom lines with a straight edge. The intersection with the diagonal bar gives the cost of Polyrad to treat that area for one year. The total cost of Polyrad for all areas treated in relation to the total refinery corrosion cost (also shown on bottom bar), indicates the remarkable returns possible.

For example, a refiner treated 25,000 bbl. a day throughput with Polyrad at 6 ppm. at an annual inhibitor cost of $6,000 for this area. In relation to this refinery's total corrosion bill of $800,000 a year, the cost of Polyrad treatments reaped big dividends.

Polyrad is readily available from stocks maintained throughout the country. A Hercules technical representative will be glad to work with you in evaluating this Hercules corrosion inhibitor under your specific operating conditions.

Naval Stores Department

HERCULES POWDER COMPANY

984 King Street, Wilmington 99, Delaware

POLYRAD®

FILMING AMINE INHIBITOR

(To obtain more data on advertised products see page 404)

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

March ★ One of a Series of Interest to the Petroleum Industry ★ 1955

HE SEES TWO PUMPS ...but his choice may be up to your dealers

Here is the second sales promotion booklet in the new series, "Looking through the windshield." It offers your dealers practical, concrete sales pointers on how to convert "regular" gasoline customers into "premium" users.

The "Looking through the windshield" series is designed and prepared to help you make better salesmen out of your dealers. It is based on information turned up by the recent Du Pont survey of Consumer Gasoline Buying Habits. The first one of a series, entitled "A close look at the man behind the wheel," tells how the dealer can increase customer loyalty.

The first two booklets in the series are now available for distribution to your dealers. Any Du Pont Petroleum Chemicals Division representative or regional office will be glad to give you sample copies . . . and cost information for ordering them in large quantities.

Cracked Stocks for Diesel Fuels?

Du Pont Fuel Oil Additive No. 2 helps provide the flexibility that makes this possible

With the rapidly expanding use of diesel power—coupled with a limited supply of straight-run distillate stocks—many refiners want an efficient way to adapt cat-cracked heating oils for diesel fuel applications. If you are concerned with this problem, the chances are good that Du Pont Fuel Oil Additive No. 2 can help you solve it.

The effective stabilizing and dispersant action of Du Pont FOA-2 can be very helpful to you for upgrading your heating oil stocks to diesel fuel. Du Pont FOA-2 also gives you added flexibility for blending cat-cracked with straight-run stocks.

Market Potential

What about the market for upgraded cracked stocks in the diesel field? Many of the railroads, for example, are now using cracked furnace oils containing Du Pont FOA-2 with good results. They have found, after careful, extensive testing, that they can efficiently operate diesel engines on well-stabilized furnace oils at substantially lower cost, and without harmful effects.

Any Du Pont Petroleum Chemicals Division representative will be glad to discuss with you how you can take better advantage of this growing market through the use of Du Pont Fuel Oil Additive No. 2.

New sales and technical service organizations set up to handle Du Pont additives

To further improve customer service, the Du Pont Petroleum Chemicals Division has set up new sales and technical groups especially to handle certain types of additives.

HEADS NEW SALES GROUP. Robert M. Glover has been appointed Assistant Sales Manager – Additives of the Du Pont Petroleum Chemicals Division, in charge of sales of gasoline additives and other additives except tetraethyl lead.

Increasing activity in these additives, as well as anticipated manufacture of others currently in the late development stages, make this expansion of services particularly desirable at this time.

Heading up sales activity in connection with antioxidants, dyes and Metal Deactivator for gasolines, and a dispersant and stabilizer for burner and diesel fuels, is Robert M. Glover, Assistant Sales Manager–Additives. Prior to this appointment, Mr. Glover was manager of the Division's Mid-Continent Region with headquarters in Tulsa, Oklahoma.

New Service Group

In addition to the sales organization, a special technical service group has been set up with headquarters at the Du Pont Petroleum Laboratory. This service group is under the direction of W. E. Bettoney, who will also act as assistant director of the laboratory. He was formerly an assistant technical manager of the Division.

Backed by the facilities of the Petroleum Laboratory, this group is in a position to offer exceptionally complete technical service for customers on all problems concerning the use of additives for petroleum products.

Two More District Offices Added

To facilitate faster and more convenient customer service in two important

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *New Organization*

areas, district offices have recently been set up in Philadelphia and Detroit. L. Z. Carey is in charge of the Philadelphia district and P. H. Richard the Detroit district.

In addition to sales activities, the Detroit office will maintain close contact with the automotive industry. Before assuming his new duties as district manager, Mr. Richard was one of the Petroleum Chemicals Division's automotive specialists.

W. E. Bettoney discusses a customer's problem with his associates. Mr. Bettoney is Assistant Director—Petroleum Laboratory, in charge of sales technical service. (l. to r., D. L. Postell, W. E. Bettoney, N. D. Lawson)

When are TWO additives CHEAPER than one?

There are many cases where the use of Du Pont Metal Deactivator in combination with other additives can result in substantially lower treating costs than the use of any single additive. This is true in stabilizing heating oils and diesel fuels as well as in stabilizing gasolines.

In Fuel Oils

Although DMD has considerable stabilizing value when used alone in fuel oils to prevent the formation of copper mercaptides, it is of maximum value when used in combination with an antioxidant and dispersant such as Du Pont Fuel Oil Additive No. 2.

And, since DMD is compatible with all known fuel oil additives, many refiners have obtained excellent results from using it in conjunction with their own additives. It also helps to improve color stability in cases where color deterioration is caused by copper contamination.

In Gasolines

The most common use of DMD is, of course, in motor gasolines. Surveys show that the great majority of all commercial gasolines contain significant amounts of copper. Therefore, since the Metal Deactivator can be used at a treating cost of less than ½ of a cent per barrel, many refiners now consider it cheap insurance to add DMD in combination with a regular antioxidant.

And most of these refiners have found that the DMD enabled them to achieve their desired stability level with smaller amounts of antioxidants—thus *reducing their total treating costs.*

Other Uses

Du Pont Metal Deactivator is also frequently used for stabilizing kerosene stocks that have been copper sweetened. In such cases, its color stabilizing properties are outstanding and it has been found to reduce carbon and coke formation in pot burners by as much as 50%.

In addition, it promises to be of considerable value for stabilizing aviation gasolines and for overcoming the tendency to cause nozzle fouling in jet fuels.

For full information on the properties, advantages and uses of this versatile additive, ask any Du Pont Petroleum Chemicals Division representative or regional office for a copy of our new Metal Deactivator booklet.

MID-CONTINENT REGIONAL MANAGER

Donald W. Frison was recently appointed manager of the Petroleum Chemicals Division's Mid-Continent region.

Mr. Frison joined the Du Pont Company in 1947 and served as manager of the Mid-Continent Regional Laboratory until 1951. He was then transferred to the Wilmington office as technical assistant to the director of sales. He later became assistant manager of sales promotion and then assistant manager of the Mid-Continent Region. Before joining Du Pont, he was engaged in CFR engine work and refined petroleum products analysis.

During World War II, he was a petroleum officer in the United States Navy Bureau of Ships and was engaged in tanker loadings at the New York Petroleum Pool.

Mr. Frison received his B.S. degree in chemistry from the John B. Stetson University in DeLand, Florida. He is a member of the Society of Automotive Engineers and the American Petroleum Institute.

DU PONT
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

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NEW YORK, N. Y.—1270 Ave. of the Americas — Phone COlumbus 5-2342
CHICAGO, ILL.—8 So. Michigan Ave. — Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue — Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. — Phone Blackstone 1151
LOS ANGELES, CALIF.—612 So. Flower St. — Phone MAdison 5-1691

IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division, 80 Richmond Street West, Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A 0034

Printed in U. S. A.

this new BJ mechanical seal takes temperatures up to 800°F!

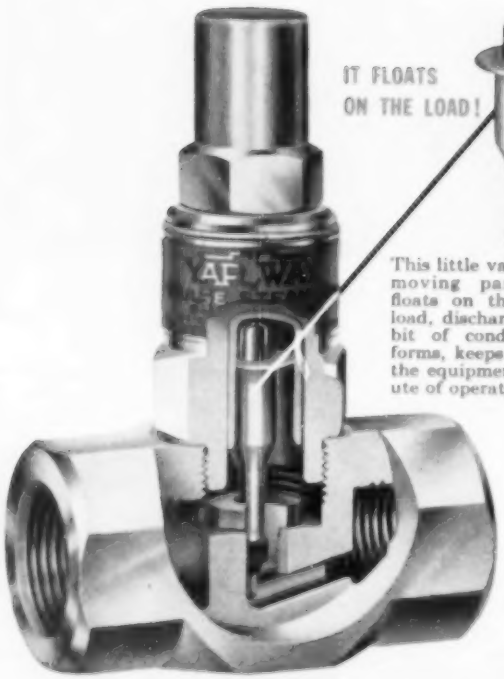
- **Proven in high temp refinery service**
- **No cold oil injection required**
- **No rotating face to sleeve gasket**
- **No stationary face to seal flange gasket**
- **Corrosion-resistant**

Here, at last, is a safe, effective answer to shaft sealing on high temperature, corrosive pumping service. This new Byron Jackson Mechanical Seal has been proved in rugged refinery service including hot asphalt and hot oil pumping (up to 800°F). It requires no cold oil injection, needs no auxiliary pumping for coolant. It is an all metal precision seal with no gaskets except shaft sleeve to shaft and seal cover to stuffingbox. New BJ High-Temp Seals are available now in any size and for any pressure encountered in refinery operation. Call your nearby Byron Jackson sales office for details or write.

You'll do better with BJ

Byron Jackson Co.
PUMP DIVISION
Since 1872
P. O. BOX 2017, TERMINAL ANNEX, LOS ANGELES 54, CALIFORNIA

3000 impulses help keep mid-west refinery "on stream"



This little valve—the only moving part—actually floats on the condensate load, discharges each tiny bit of condensate as it forms, keeps hot steam in the equipment every minute of operating time.

THIS big refinery at Lawrenceville, Ill.—like a lot of other important refineries — uses Yarway Impulse Steam Traps.

Over 3000 Yarway Impulse Traps are installed on tracer lines and for draining steam headers.

Popular features of the Yarway Impulse Steam Trap are its ability to get equipment *hot in a hurry*—and keep it hot! . . . also its small, handy size—fits in easily in any location; its stainless steel body and working parts; quick installation; easy maintenance; low initial cost.

Another advantage—IMMEDIATE DELIVERY from 250 local distributors, plus quick service from nearby Yarway field engineers.

More than 900,000 Yarway Impulse Steam Traps have been sold. For a free Steam Trap Selector, write . . .

YARNALL-WARING COMPANY
153 Mermaid Ave., Philadelphia 18, Pa.

YARWAY impulse® steam trap

(To obtain more data on advertised products see page 404)

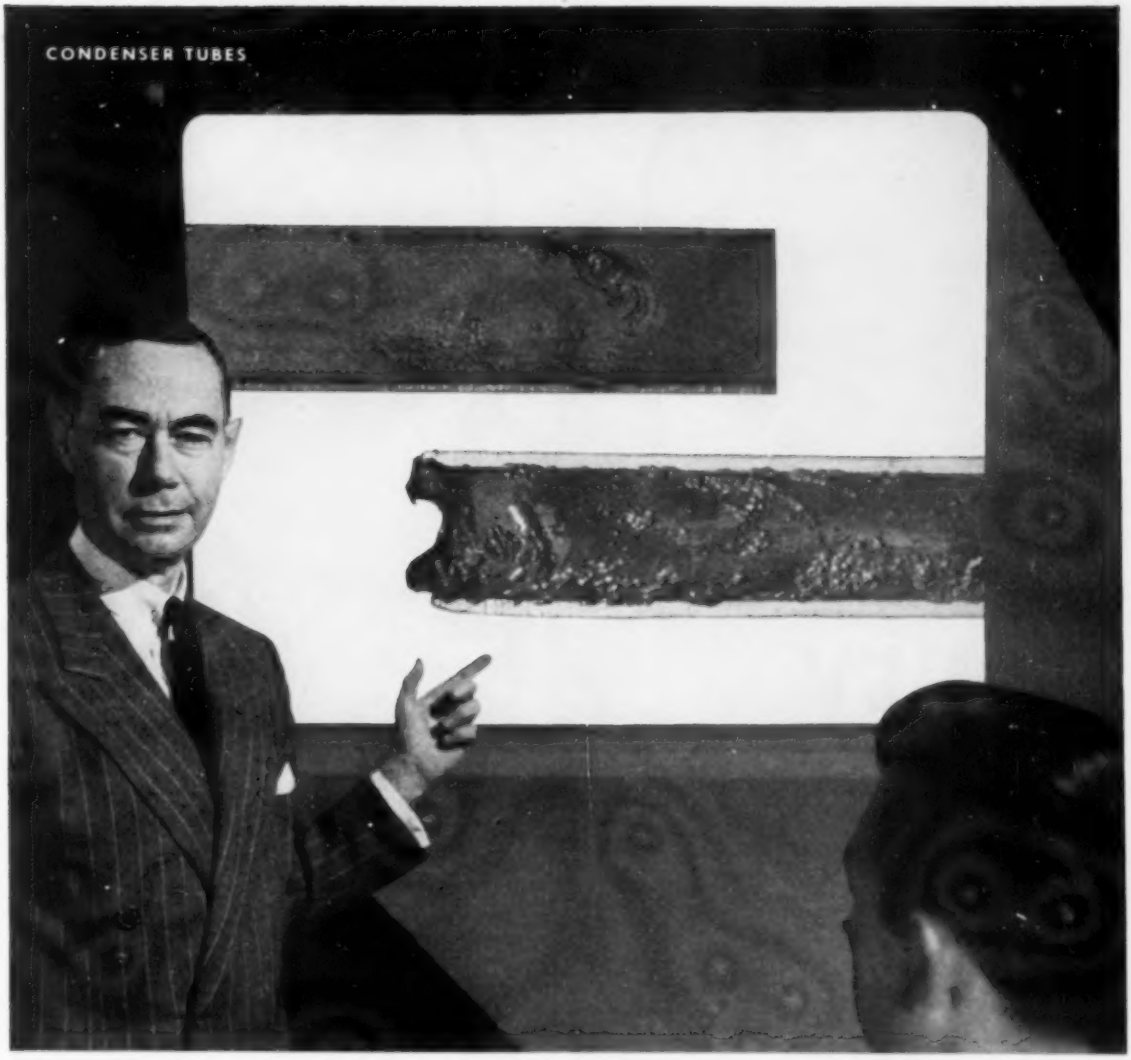


Illustration at bottom shows effect of high-velocity turbulently flowing sea water on the inlet end of an Admiralty tube. At the top you see the effect of high-velocity, turbulent flow of sea water around once-lodged pebble or shell in Admiralty tube cooled by sea water.

VELOCITY: how serious tube damage from this cause can be avoided

High velocity is a big factor in causing turbulent flow of the cooling water. This in turn may lead to rapid inlet-end corrosion of condenser tubes, particularly in plants on tide water. You can smooth out the flow of water by using deep water boxes and by flaring the inlet ends of tubes. And you should do away with water obstructions. All these help to increase tube life.

Where a tube is partially blocked by a pebble, shell or other debris, local high velocities can occur. It is highly desirable to prevent the entrance of such material into condenser tubes. But it's not always possible. If you want to avoid serious damage from this cause, inspect and clean tubes frequently.

Velocity is only one factor affecting tube life. Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers," discusses *all* the important operational factors, and gives much other useful information. And, of course, our Technical Department stands ready to assist you in the selection of tube alloys from our extensive line. *The American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.*

ANACONDA®

Tubes and Plates for Condensers and Heat Exchangers

Arsenical Admiralty-439; Ambraloy-927®; Cupro Nickel, 30%-702; and other copper alloys

U. S. Patent No. 2,905,806 (Other)

(To obtain more data on advertised products see page 404)

SAVING MONEY FOR USERS

WEDGEPLUG NON-LUBRICATED STEEL PLUG VALVES

...In Both HEMISPHERES

Wedgeplug Valves are scientifically designed so that the plug is lifted from its protected seats, makes a full 90° turn, and is reseated—all in one simple, conventional operation. **No lubricants are needed to free the plug from the body seats, or to seal the plug from leaking after operation.** Dependable performance, at a wide range of temperatures and pressures, has made Wedgeplug Valves an international favorite. **Write for the Wedgeplug Catalog.**

WEDGEPLUG VALVES ARE SERVING OUTSTANDINGLY

Throughout the UNITED STATES and CANADA, and in:

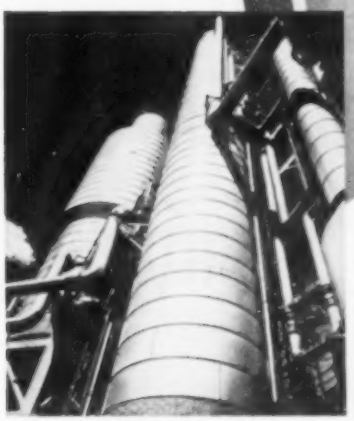
- MEXICO
- COLOMBIA
- ARUBA
- BRAZIL
- ARGENTINE REPUBLIC
- VENEZUELA
- SOUTH AFRICA
- ITALY
- FRANCE
- ENGLAND
- SCOTLAND
- WALES
- HOLLAND
- BELGIUM
- GERMANY
- SAUDI ARABIA
- IRAN
- INDIA
- JAPAN
- MALAYA
- INDONESIA
- PHILIPPINES

WEDGEPLUG VALVE COMPANY, INC.
NEW ORLEANS 25, LA.

An Affiliate of

STOCKHAM VALVES & FITTINGS
GENERAL OFFICES AND PLANT • BIRMINGHAM 2, ALA.

STRUCTURAL STABILITY—
Low-cost carbon steel backing provides necessary strength and rigidity.
DESIGN FREEDOM—
Integral bond allows design and fabrication of shapes to meet process and space needs.
ECONOMY—
High-alloy layer assures corrosion resistance, long equipment life.



Stainless-clad and monel-clad steels combine to handle corrosive asphalt crude containing up to 2.5% sulfur concentrations at 750° F in this vacuum still.

CLAD STEEL EQUIPMENT GIVES SOLID HIGH-ALLOY PROTECTION AT LOWER COST

With protection against the corrosive action of sulfuric feeds at high temperatures a "must" to avoid unscheduled shutdowns, clad steel equipment is often the *economical* answer. Cladding and backing are permanently and integrally bonded over their entire surface, eliminate the chance of seepage or crevice corrosion. Smooth, uniform clad surfaces permit easy cleaning, drainage and inspection.

Why not investigate clad for your new processing equipment. Lukens Clad Steels—stainless, nickel, Inconel, Monel, copper—give you all the advantages of these solid high-alloys with savings up to 50% in material costs.

In addition to low first cost, clad steel permits easy and economical field erection. When you're thinking of new tanks and pressure vessels, *qualified* equipment builders can help you take advantage of the versatility of Lukens Clad Steels. Working with your engineers and consultants from the start, they tailor equipment to your exact needs. We offer the widest range of clad steels available and work closely with fabricators to help select the type most suited to your processing needs. If you would like further information, ask one of your builders or write Manager, Marketing Service, Lukens Steel Company, 752 Lukens Building, Coatesville, Pennsylvania.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE

(To obtain more data on advertised products see page 404)

Natural gas producers, small and large, are convinced that if the American people understand the issues regarding federal regulation they will reach the right decision. Therefore, we are endeavoring to lay the subject before the people and to encourage the fullest possible discussion of the issues. To do so, this advertisement has been placed in newspapers throughout the country.

What the Regulation of Gas Supply Means to 25,000,000 American Families

THE FIVE THOUSAND producers of natural gas—large and small—believe that the free competitive system which has increased your gas supplies and kept rates low is the best for consumers, for the industry, and the economy.

They believe the proposal to abandon competition and clamp bureaucratic controls on gas production will hurt consumers, damage the industry, and *benefit no one*.

Here are some answers to questions you as a consumer may have on this vital issue.

What Is This Regulation?

Sixteen years after a 1938 law was passed, a new interpretation of some of its words now forces the Federal Power Commission to do what it has eleven times refused to do—try to fix the price that an interstate pipeline pays the 5000 competing producers who find the gas and get it from the ground.

Will This Regulation Reduce Our Gas Bills?

Hardly. Only about 10% of the average gas bill goes to the producer who finds the gas and sells it. The other 90% pays for constructing, maintaining and operating the long-distance pipelines and local distribution systems—already regulated.

How Will Regulation Affect Supply?

It will reduce the supply. Most natural gas is produced by "wildcatters" and other independents. They are used to keen competition and big risks. But put them under Federal controls—with permits, endless forms, licenses, hearings and suits—and the work of exploration is sure to suffer. Three new pipeline projects to bring gas to more consumers have been suspended since regulation took effect.

Hasn't Gas Always Been Regulated?

Gas *distribution*, yes. It makes sense to have only one pipeline bring gas to a community—and one gas company distribute it in the community. Both do a good, efficient job for you, and as monopolies they are naturally regulated.

But there's no monopoly in *finding* gas. Far from it. Gas *production* is risky and keenly competitive. There are five thousand large and small producers looking for gas—and finding it in only one out of

 (To obtain more data on advertised products see page 404)

every nine exploratory wells they drill. They compete vigorously to sell their gas. A single pipeline may buy from 200 or more producers.

Is Gas Different from Coal or Oil —or Grain?

It isn't. And if there's price-fixing for natural gas at the well so can there be next for coal at the mine or oil at the well—or lumber in the forest, or grain on the farm.

How Did The Consumer Fare Before This Regulation?

Here's the record. In the past 16 years natural gas production has increased 200% and the price the consumer paid for gas has risen only 1/11th as much as the general cost of living.

Do Only A Few Big Companies Produce Gas?

No. The largest 37 companies produce less than half the nation's gas. No single company produces more than 5%. The small producers do more exploratory drilling than do all the big companies combined. And none of the producers has any monopoly, any exclusive franchise, or any protection.

What Is The Natural Gas and Oil Resources Committee?

It is made up of companies and individuals concerned with natural gas. It includes a great many large and small gas and oil producers. All believe there is no more reason for OPA-like price-fixing on gas than on steel, coal, autos, meat, or shoes, which could be next. All believe that free competition is better for all of us than a price-controlled economy, which has historically led to stagnation, scarcity and rationing.

What Can I Do?

You can reason out the issues, reach your own conclusions, and make those conclusions known to your friends and neighbors.

Under free competition without federal regulation—

- Natural gas became plentiful—output rose two hundred per cent in the past sixteen years.
- Natural gas stayed reasonable—and gas prices to the consumer rose only one-eleventh as much as living costs in the past sixteen years.
- Natural gas has helped create thousands of jobs in industry and now supplies one-fourth of the nation's energy resources.

NOW . . . . . cumbersome federal controls threaten all this progress.

FOR MORE FACTS WRITE FOR THIS BOOKLET NOW!

You have the right to know the facts about this new government regulation—a peacetime control of free, competitive producers. Send today for the booklet, "Natural Gas—A Key Resource in Jeopardy."

NATURAL GAS

NATURAL GAS AND OIL RESOURCES COMMITTEE

Room 5401, 350 Fifth Avenue, New York 1, N. Y.

(To obtain more data on advertised products see page 404)

Bingham

STUFFINGBOXLESS PUMPS

HANDLE AT HIGH

FIREPROOF AND EXPLOSION-PROOF! Leakage of vapor or liquid to atmosphere or leakage from outside into pump is impossible. Not only is plant and personnel protected, but loss of valuable pumpage is prevented. Type KC High-Pressure Single-Stage Stuffingboxless Pump illustrated.

NO STUFFING BOX! NO PACKING!

Bingham Stuffingboxless Pumps are successfully handling liquids having high vapor pressure, requiring high suction pressure and, frequently, abnormally low pumping temperature (—300° F). Standard models handle suction pressures up to 2,000 psi (higher pressures available). Pumping temperatures to 850° F and higher also can be handled. These conditions present no difficulty for Bingham Stuffingboxless Pumps, but they are difficult and sometimes impossible to meet with conventional pumps due to limitations imposed by the stuffing box.

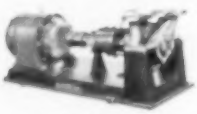
Because there is *no stuffing box*, Bingham Stuffingboxless Pumps eliminate all the disadvantages of conventional pumps operating with stuffing boxes equipped with packing or mechanical seals.

Bingham Stuffingboxless Pumps are in service today all over the world, with distinguished records in reliability, continuity of service, and low maintenance. Write to your nearest Bingham office for Bulletin 107 or for additional information.

***And other volatile liquids.**

TYPICAL BINGHAM "DOUBLE VOLUTE"

The Bingham Type HPD "Double Volute" Multi-Stage Double Case "Hi-Press" pump for extremely high pressure service.

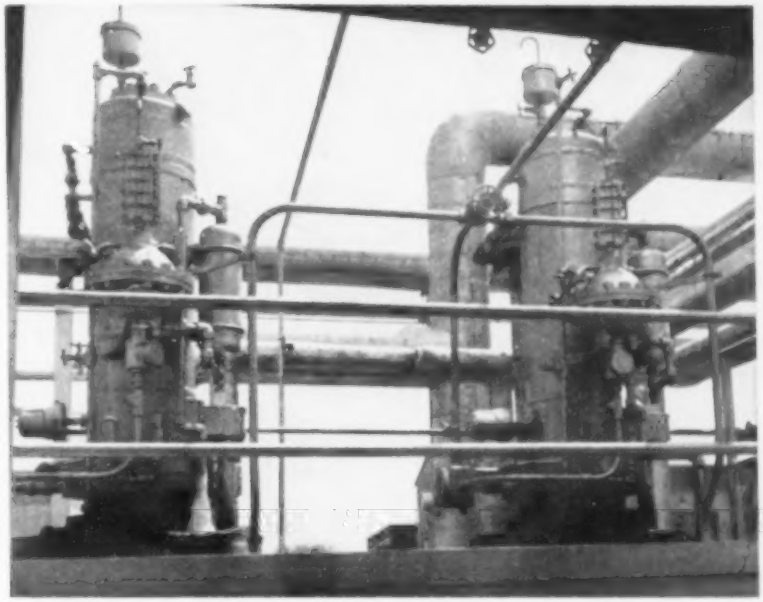


Bingham Type CAD "Double Volute" Single-Stage Process Pump.

Bingham Type CJ "Double Volute" Two-Stage Process Pump.

Bingham Type CD "Double Volute" Double Suction vertically-split case pump for hot service.

LIGHT HYDROCARBONS* SUCTION PRESSURES



Battery of Bingham Stuffingboxless Pumps handling light hydrocarbon at low temperature, under high suction pressure. Tennessee Gas Transmission Co. plant, Gabe, Kentucky.

Bingham PUMPS
SINCE 1921

DOUBLE VOLUTE DOUBLE SUCTION

BINGHAM PUMP COMPANY
General Offices: **2800 N.W. Front Avenue, Portland 10, Oregon**
Factories: **Portland, Ore. • Vancouver, B.C., Canada**

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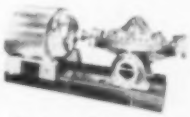
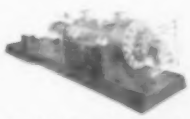
PUMPS FOR PETROCHEMICAL SERVICE

Bingham Type CM "Double Volute" vertically split case two-stage pump for hot service.

A Bingham Type CKA "Double Volute" Single Stage Koke-Krusher for coke-laden pumpage.



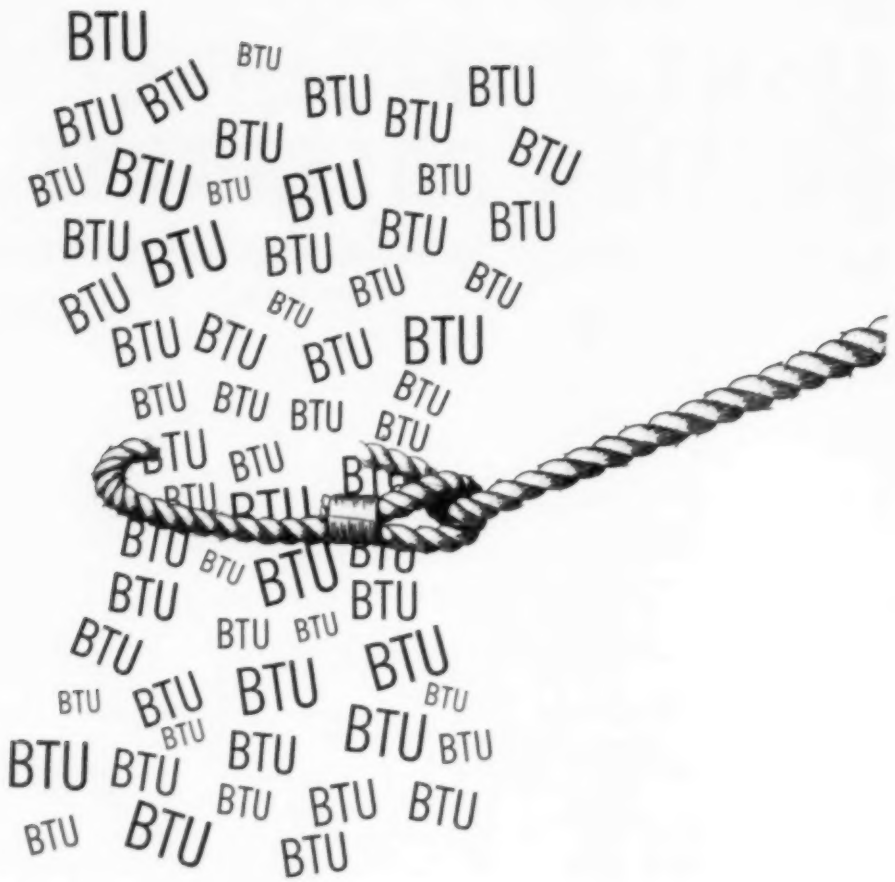
Bingham Type HSB "Double Volute" Double Suction Pump for high heads.



Bingham Type CP "Double Volute" Multi-Stage, Double-Case pump for hot or cold service.

Bingham Type VCP Vertical Pump for low NPSH conditions, featuring bottom dismantling.

(To obtain more data on advertised products see page 404)



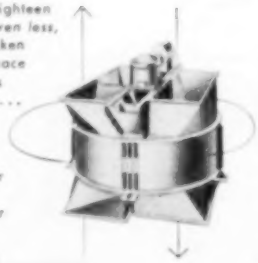
cut fuel costs

you can save one barrel in every five with the Ljungstrom® Air Preheater

HOW FAST IS "WRITE OFF"?

In fuel savings alone, most refiners write off the cost of the Ljungstrom installation in twelve to eighteen months. This time is cut to nine months and even less, when the other Ljungstrom advantages are taken into account – permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . boosts product quality . . . and minimizes slag.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat-recovery benefits attainable in fuel burning equipment – call or write The Air Preheater Corporation.



The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

How much fuel do your process units burn *just to keep the stacks hot?* It takes precious BTU's to keep them as hot as they are . . . BTU's that, if recaptured, would be working for you – instead of costing you money.

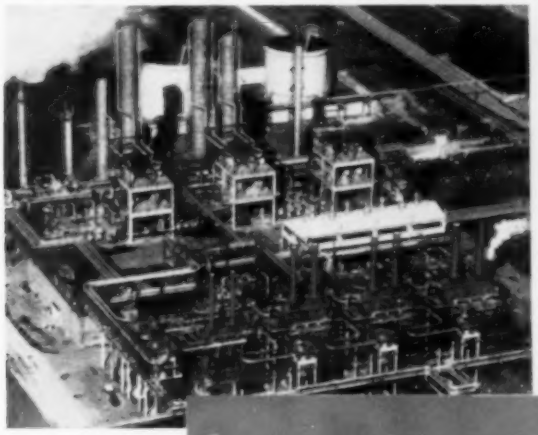
With the Ljungstrom, much waste heat is recovered from exit gases, transferred to incoming combustion air and funneled back into the furnace. How much fuel does this save? You get an idea when you consider that for every 45-50° F of preheat, your fuel bill drops 1% – and Ljungstrom Air Preheaters now in use preheat air to over 1,000° F.

That's why a Ljungstrom saves you up to 20% of your fuel costs – *one barrel in every five.* In fact, one midwestern refiner reports $74,200 saved in fuel in one year. And after he subtracted the Ljungstrom operating cost, he still wound up the year $64,300 ahead.

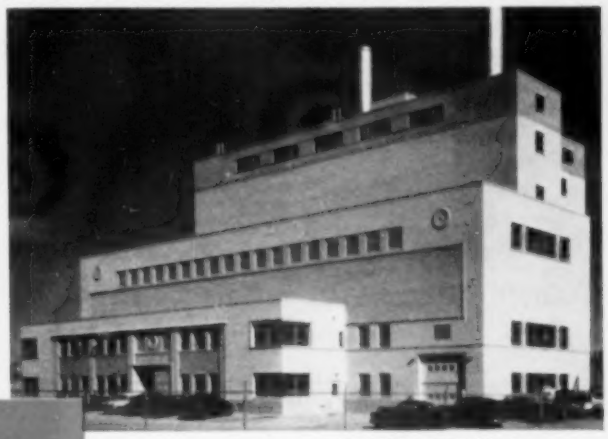
The Air Preheater Corporation **60 East 42nd Street, New York 17, N. Y.**

(To obtain more data on advertised products see page 404)

for PETROCHEMICALS or POWER



Sun Oil Company petrochemical plant, Marcus Hook Pennsylvania



Power plant, Colorado Springs Department of Public Utilities

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Can Add Higher Strength at Lower Cost to Your Alloy Piping System

Whether your product is petrochemicals . . . power . . . or anything else requiring an alloy piping system, an investment in Key-Kast fittings can add higher strength and longer life to that system—and at a real economy, too. Here's why:

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- Lower unit cost
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Key-Kast fittings are available in every shape, size, schedule—in low and intermediate alloys and various stainless steels

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Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

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HARSHAW'S

Continuous Research Develops

stronger *tableted* catalysts

THE HARSHAW CHEMICAL COMPANY

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Taken at 1/20,000th of a second, the pictures show a Harshaw catalyst tablet being tested for strength—one step in our research program designed to produce more efficient tableted catalysts having the highest useful strength. Our goal, of course, is to make the catalyst you want and need. First you specify, and then we produce.

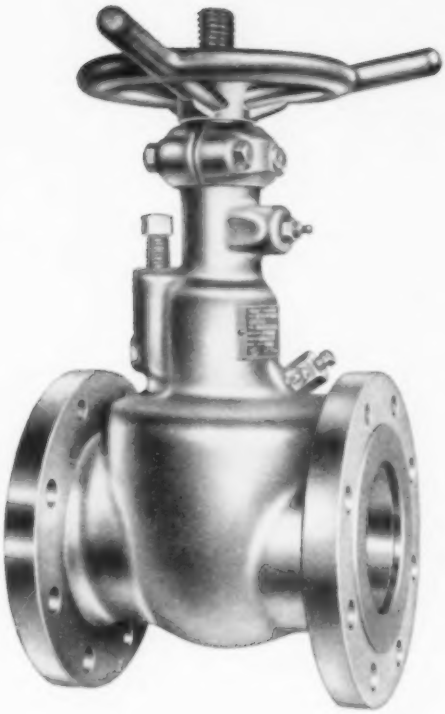
Tougher, more efficient catalysts mean fewer reactor shutdowns, and, naturally, more economic operation for you. Harshaw Catalysts mean fewer reactor shutdowns.

If your mind's on catalysts please contact us today by phone or letter.

HARSHAW CATALYSTS
available in these forms:

- Tablets
- Extrusions
- Granules
- Flakes
- Powders
- Spheres
- Rings

(To obtain more data on advertised products see page 404)



MAXIMUM FLOW

characteristics

with MINIMUM pressure drops

ORBIT VENTURI VALVES

When you buy Orbit Forged Steel Venturi Valves, you can be sure that they are designed to give maximum flow characteristics with minimum pressure drops.

Three important features of the Orbit Forged Steel Venturi Valve design are:

1. *The tapered sections are smoothly machined and are gradual so as to eliminate serious frictional losses.*
2. *The diverging conical downstream passage reduces pressure drops to a minimum.*
3. *The entrance and exit walls of the conical sections are held at minimum angles.*

Orbit Venturi Valves are compact in design yet are built for continuous heavy duty service.

Available in flanged end only, ASA Class, Carbon Trim, Stainless Trim, Sizes: 2", 2½", 3", 4" and 6", beginning with 150 Lb. Class.

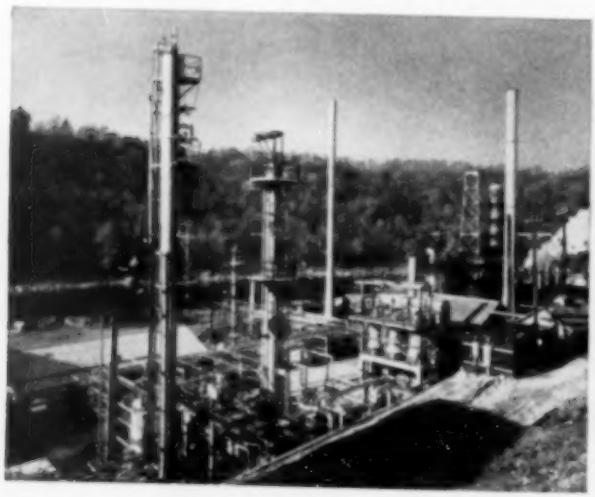
Available also in Full Round Opening ASA Class, Sizes: 1", 1½" 2", 2½", 3", 4", beginning with ASA 300 Lb. Class. Screw and Flanged Ends.

ORBIT VALVES ®

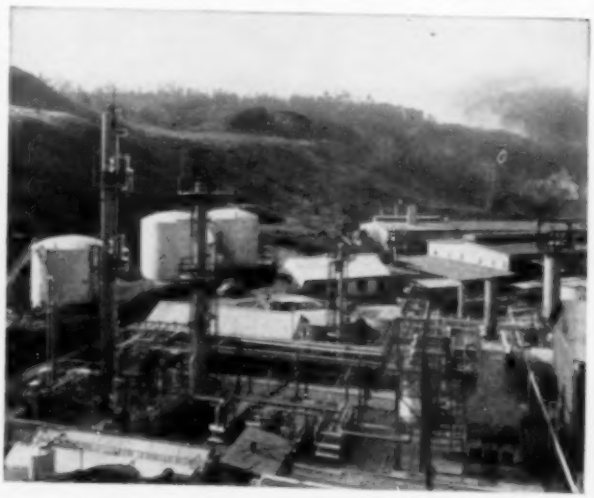
ORBIT VALVE COMPANY

P. O. BOX 699 TULSA, OKLAHOMA

Standing out in bold relief are the reactor-heater section (left) and compressor house of the 1,500 barrel per day UOP Platforming unit — the largest of three built for Quaker State Oil Refining Corporation — at the company's Farmer's Valley, Pa., refinery.



The Allegheny River is only a stone's throw from the Platforming unit at Quaker State's refinery at Emlenton, Pa. The unit has a daily capacity of 1,000 B/SD.



Rolling hills loom behind the 1,000 barrel per day Platformer at the St. Marys (W. Va.) refinery of Quaker State. The unit is a duplicate of the one at Emlenton.

Advertisement

Three UOP Platforming Units Solve Pressing Octane Problem For Quaker State Oil Refining Corp.

By Guy B. Hunter
Executive Vice President
Quaker State Oil Refining Corporation
Oil City, Pennsylvania

OUR company recently concluded a three-way program of product improvement which was highlighted by the installation of three UOP Platforming units, thus giving Quaker State Oil Refining Corporation the distinction of being the first independent refiner to build three of these units at one time.

Guy B. Hunter

Quaker State for more than half a century has been world renowned for its lubricating oils. Its gasolines, distributed under the brand name of "Sterling," have enjoyed an equally high reputation in the marketing areas of our three refineries at Farmer's Valley and Emlenton, Pa., and St. Marys, W. Va. The English pound sterling sign, symbol of our gasolines, always has been the motorist's assurance that he was purchasing the highest quality motor fuels that the petroleum refining industry was able to produce.

We experienced little or no difficulty in meeting octane requirements as the trend moved upward toward more powerful gasolines, but as the level approached 93 we were confronted with a serious problem because our thermal cracking equipment could not be operated economically above that figure. It was therefore apparent that if "Sterling" gasolines were to continue their leading position, another way must be found to increase our octanes.

Planned for the Future

We not only had the immediate problem of producing a higher quality motor fuel but we, like so many other independent refiners, also had to "take out insurance" against the day when octane levels would be still higher. A thorough study of the catalytic reforming field convinced us that the UOP Platforming process was indeed the answer to the situation and would give us an ample octane potential cushion for the future.

We based our decision to install Platforming at all of our refineries on four major factors which were, briefly, the commercially proved experience of Platforming; the proved reliability and the many years of satisfactory service we received from Universal Oil Products Company; the high degree of market flexibility which the process would give to our operations, and the conviction that we would be equipped to meet all anticipated octane increases in the foreseeable future.

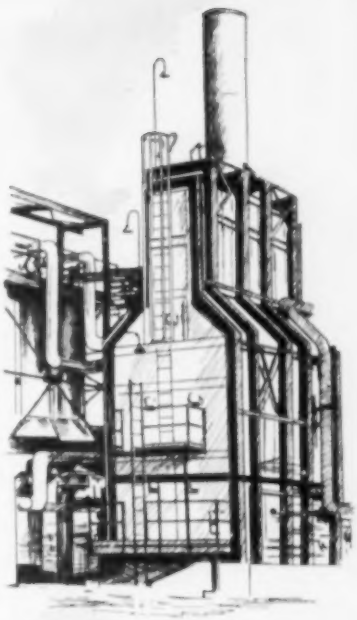
Operation of the three Platformers has convinced us that our selection was a wise one. "Sterling" gasolines now are among the highest octane motor fuels available in our marketing areas, which are concentrated through the heart of the Allegheny Mountains in Western Pennsylvania and along the upper reaches of the Ohio River in West Virginia. Additionally, through Platforming, we have been able to increase substantially our overall cracking capacity by utilizing existing thermal reforming equipment for more extensive cracking service.

Full Boiling Range Gasoline

Quaker State is among the first to produce a 98 leaded octane Platformate. Furthermore, when the unit at Farmer's Valley went on stream, it marked the first time that a Platformer in the Eastern part of the United States was operating on full boiling range gasoline.

The same type of charge stock is fed to the Platforming units at Emlenton and at St. Marys. It boils in the range of 80° F. to 400° F., and it is low in naphthene content. Despite the fact that the feed stock contains an unusually high contaminant concentration, special provisions in the design of the units have enabled us to maintain satisfactory operations at the desired octane number.

We are more than satisfied with the operation of our three Platforming units, which give us a daily capacity of high quality gasoline as follows: 1,500 B/SD at Farmer's Valley and 1,000 B/SD each at Emlenton and St. Marys. From the standpoint of economics, we are pleased to report that Platforming has made it possible for Quaker State to produce 98 leaded octane gasoline at a yield of 81.8 per cent as against our previous operations by which we produced a 93 leaded octane product at 72 per cent yield.



QUAKER STATE
FIRST INDEPENDENT
REFINER TO BUILD
3 UOP PLATFORMERS
AT ONE TIME

designed, engineered and licensed by

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30 ALGONQUIN ROAD,
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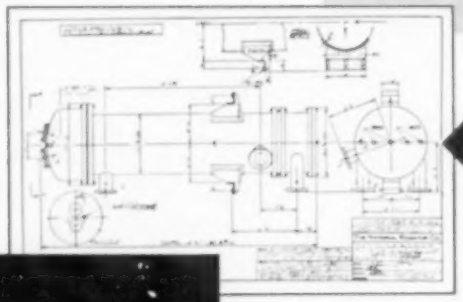
SHELL and TUBE HEAT EXCHANGERS

Your heat exchanger problems will be handled completely and efficiently from individual specifications . . .



through latest design to highest standards

and careful fabrication . . .

to finished product

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NRC

WE WELCOME YOUR INQUIRIES!

by the *Heat Transfer Division* of

THE NATIONAL RADIATOR COMPANY

JOHNSTOWN, PENNSYLVANIA

HEAT TRANSFER DIVISION HEADQUARTERS 60 East 42nd Street, New York

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

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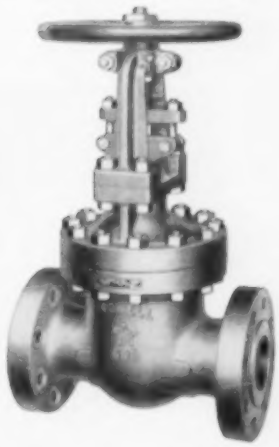
POWELL VALVES FOR MODERN INDUSTRY

FIG. 2193—Ni-Resist* Gate Valve for 200 Pounds W.O.G.

FIG. 6061 SS—600 Pound Stainless Steel Swing Check Valve

FIG. 6003 SS—Alloy Steel Gate Valve for 600 Pounds W.S.P.



*Trademark of The International Nickel Co.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

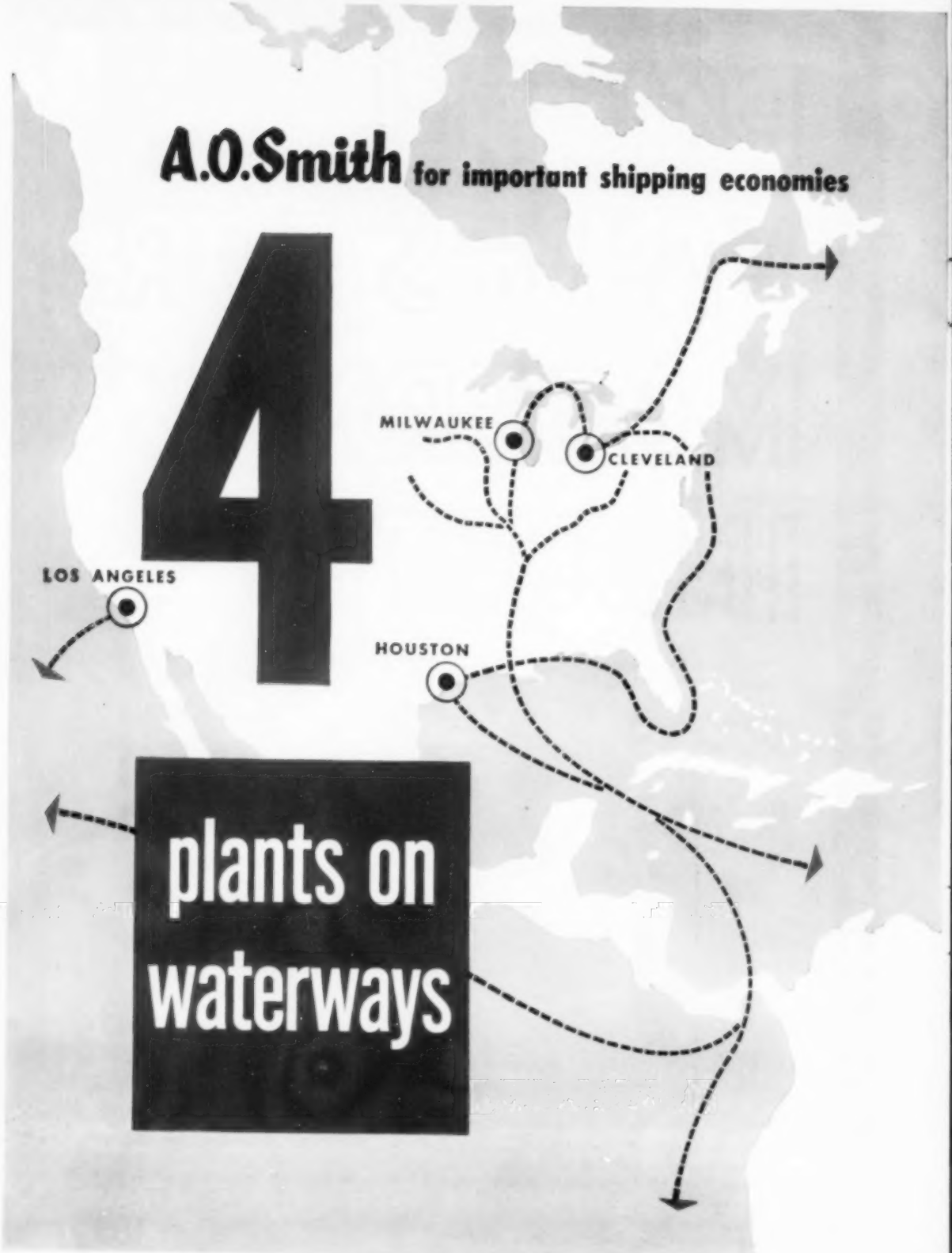
125

When you think of valves—think of Powell. For Powell has a *complete* quality line. Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

Shown above are just a few Powell Valves. Investigate these valves . . . *and* the *complete* line of quality valves made of bronze, iron, steel, special alloys and pure metals.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write . . .

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year


A.O.Smith for important shipping economies
4
plants on waterways
MILWAUKEE
CLEVELAND
LOS ANGELES
HOUSTON

92,000-lb. synthesis converter being loaded for shipment at Milwaukee to Norsk Hydro Elektrisk Kvaelstofaktuselskat at Glomford, Norway. Featuring exclusive MULTI-LAYER construction, the unit is 40-ft. face to face, with 31½ in. ID and 3⅛ in. wall thickness. Designed to operate at pressures of 3556 psi.

Save on shipping costs . . . because our Milwaukee, Cleveland, Houston and Los Angeles vessel plants are located on waterways . . . because this provides for direct, economical transportation of large pressure vessels and heat exchangers to domestic and foreign ports. If your operations are near waterways, you can well imagine the advantages inherent in this strategic location of A. O. Smith manufacturing facilities.

Erection problems reduced . . . because waterway shipment permits delivery of fractionators, converters, accumulators, stainless and glass-lined reactors, as well as other larger vessels in one or, at most, two pieces. You can avoid field assembly costs . . . or, at least, reduce them considerably. The overall result is welcome economy in time and money.

Another good reason why it pays to see A. O. Smith first when you contemplate the purchase of pressure vessels and heat exchangers. We'd be glad to tell you about some of the other good reasons why it's good business to deal with A. O. Smith. Your letter to our Milwaukee office will bring a prompt reply.

Through research ...*a better way*

A.O.Smith

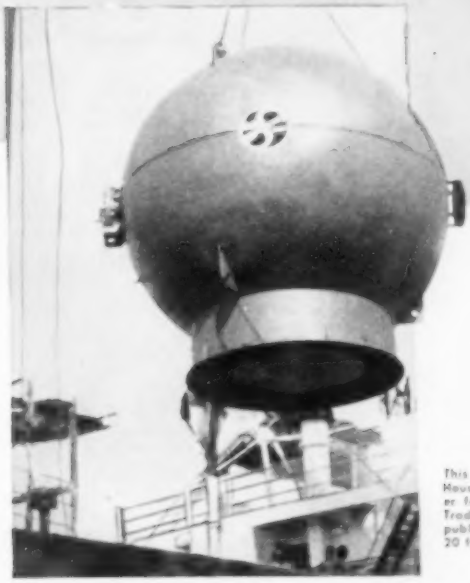
CORPORATION

PROCESS EQUIPMENT DIVISION

MILWAUKEE • HOUSTON • LOS ANGELES

International Division: Milwaukee 1

for glass-lined process equipment, contact GLASCOTE PRODUCTS, INC., Cleveland 17, Ohio an A. O. Smith Subsidiary.

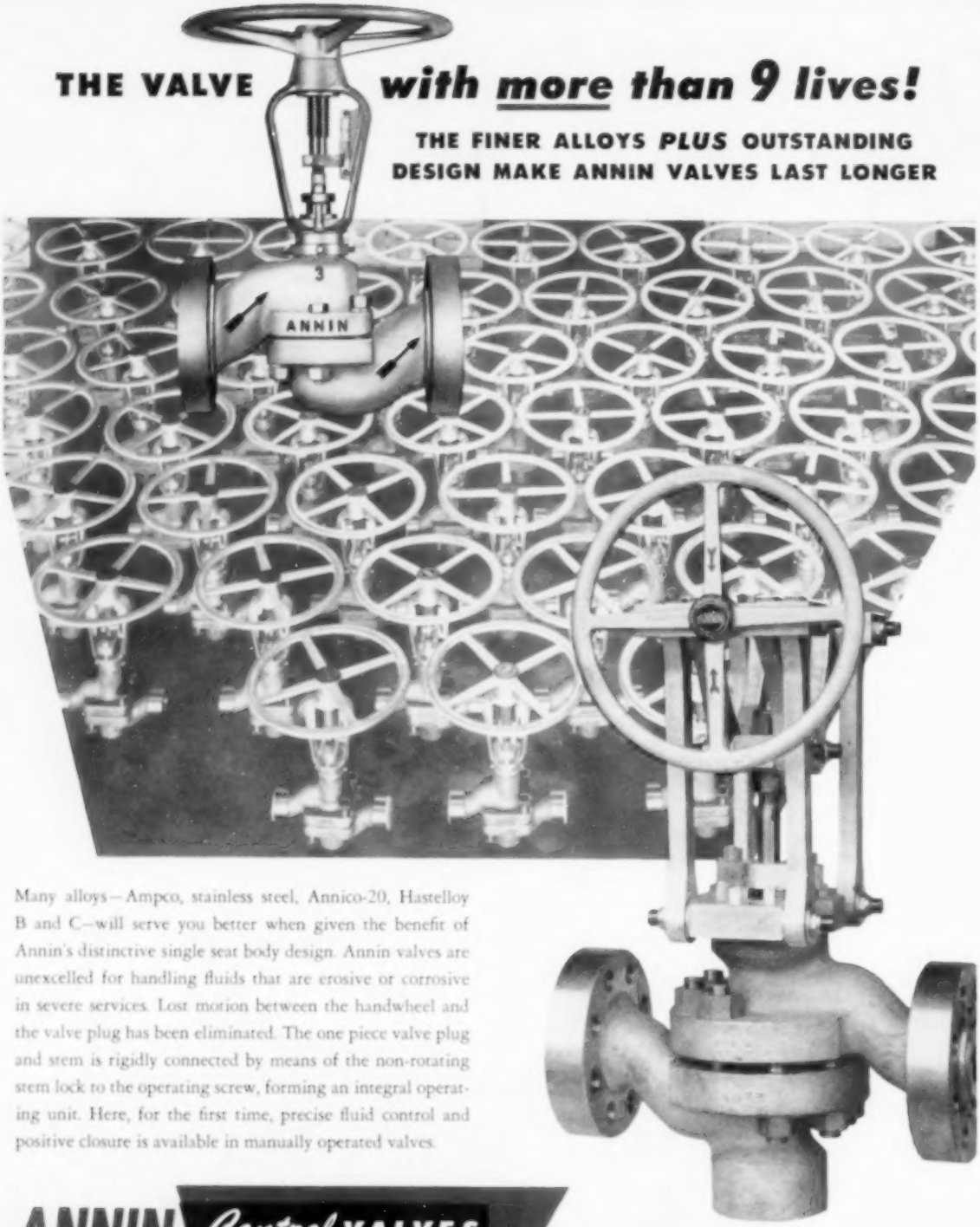


This furfural digester, produced at A. O. Smith's Houston plant, is being loaded aboard a freighter for shipment to the South Porto Rico Sugar Trading Corporation, La Romana, Dominican Republic. Weight is 73,780 lbs. . . . diameter is 20 ft. . . . walls are 1-in. thick.

Weighing 181,200 lbs. each, these giant coking drums are being barge-loaded at Milwaukee for shipment to the Pure Oil Company's installation at Toledo, Ohio. Shipping route is up Lake Michigan, through the Mackinac Straits, along Lake Huron to Lake St. Clair . . . then to Toledo by way of the Detroit River and Lake Erie.

THE VALVE *with more than 9 lives!*

THE FINER ALLOYS *PLUS* OUTSTANDING DESIGN MAKE ANNIN VALVES LAST LONGER



Many alloys—Ampco, stainless steel, Annico-20, Hastelloy B and C—will serve you better when given the benefit of Annin's distinctive single seat body design. Annin valves are unexcelled for handling fluids that are erosive or corrosive in severe services. Lost motion between the handwheel and the valve plug has been eliminated. The one piece valve plug and stem is rigidly connected by means of the non-rotating stem lock to the operating screw, forming an integral operating unit. Here, for the first time, precise fluid control and positive closure is available in manually operated valves.

ANNIN *Control* **VALVES**

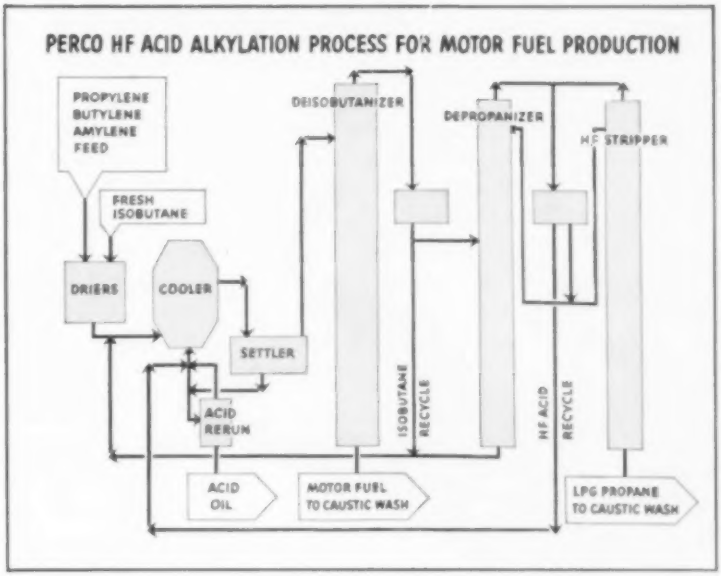
Investigate ANNIN MANUAL AND AUTOMATIC VALVES in alloys or carbon steel for pressures to 30,000 psi

THE ANNIN COMPANY 6570 EAST TELEGRAPH ROAD, LOS ANGELES 22, CALIF.

PERCO HF ALKYLATION

The economical route to

HIGHER OCTANE MOTOR FUEL



Liquid feed, containing olefins and isobutane, is passed through driers and fed into a cooler along with liquid recycle hydrofluoric acid. Hydrocarbons and recycle acid then flow to the settler. The acid phase is recycled to the cooler. The hydrocarbon phase is fractionated to separate high octane motor fuel alkylate from recycle isobutane.

● On Christmas Day, 1942, Phillips began operating the world's first HF Alkylation unit. Phillips designed this plant from data developed in Phillips laboratories and pilot plants. Today, the original unit is still operating, with its original capacity increased from 1,750 to 12,000 barrels per day.

Now, Perco Division offers refiners a simple, streamlined and thoroughly proved HF Alkylation process that incorporates the many benefits of Phillips unmatched operating experience with this process.

Construction and operating expenses are low.

Perco HF Alkylation requires no more utilities and manpower than does an equivalent cat-poly unit. Yet yield, based on olefin content, is about 2½ times better for HF Alkylation compared with catalytic polymerization. ASTM distillation final end point is appreciably lower for HF Alkylate compared to cat-poly gasoline. Furthermore, TEL and normal butane blending values are particularly attractive with motor fuel alkylate.

HF Alkylation licensed by Perco includes rights under the patents of Universal Oil Products Company and thus confers full patent protection to the licensee. Consult today with Perco about the advantages of HF Alkylation for production of higher octane motor fuels.

PERCO *Division*

Phillips 66

PHILLIPS PETROLEUM COMPANY

BARTLESVILLE, OKLAHOMA

PERCO®

®A SERVICE MARK

(To obtain more data on advertised products see page 404)

WHEN YOU'RE UP IN THE AIR

OVER PROCESS EQUIPMENT...

(To obtain more data on advertised products see page 404)

THE ANSWER IS

KELLOGG-ENGINEERED

FABRICATION

We emphasize "engineered" because M. W. Kellogg means much more than just putting together heat exchangers, pressure vessels, piping and other process equipment. Backed by a complete metallurgical and welding research staff, Kellogg process equipment is designed and fabricated by men who are recognized authorities in the field of heat transfer, stress analysis, welding techniques, non-destructive testing—and who constantly keep up with what is happening for tomorrow.

You can save many precious man-hours for your own engineers with Kellogg-engineered process equipment. You can assign the design problem to Kellogg or have Kellogg review your own design engineering to assure an optimum design. Your engineers will find it stimulating and profitable to work with the Kellogg staff.

Kellogg process equipment means top performance at minimum investment and prompt deliveries. It is engineered for the job by engineers who *know* their jobs. If recently you have not had firsthand experience with the Kellogg Fabricated Products Division, we would welcome the opportunity to describe our expanded services and manufacturing facilities.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.
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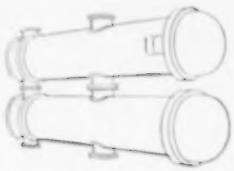
GET IT RIGHT FROM M W KELLOGG



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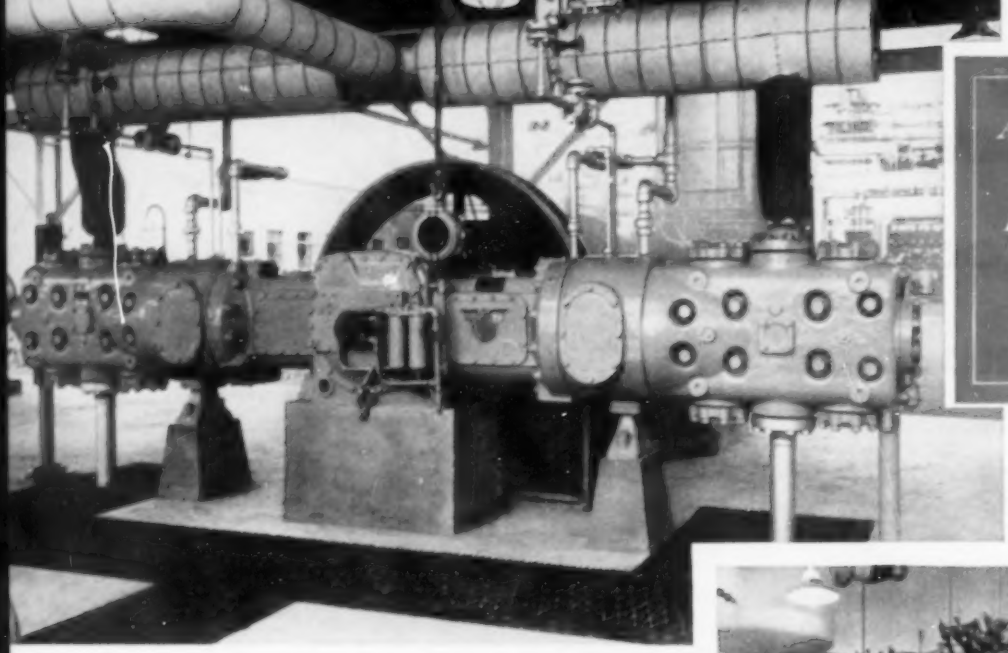
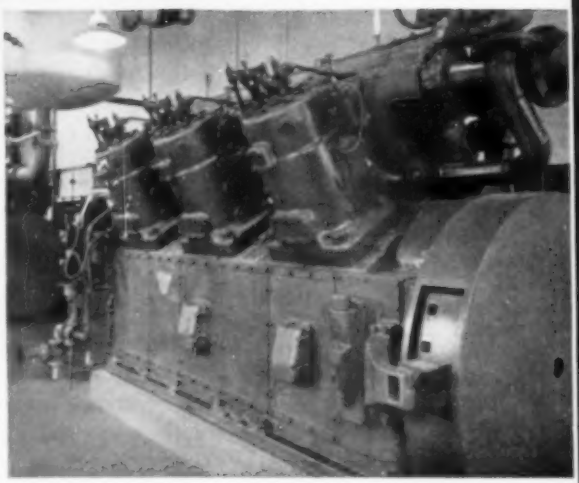


Another Example of Efficient Power at Lower Cost

One of the two Cooper-Bessemer EM compressors, rated at 300 hp, serving in Canadian Oil's UOP Platforming operation. Note the simple, neat and compact arrangement of this "open air" unit.

EM's and GMX's at Sarnia...

NEW HIGH'S IN COMPRESSOR EFFICIENCY for higher octane gasoline



Two 6-cylinder Cooper-Bessemer GMX compressors, rated at 330 hp at 400 rpm, being installed to recirculate gas for the Houdriformer process at Sun Oil Company's new Sarnia, Ontario plant.

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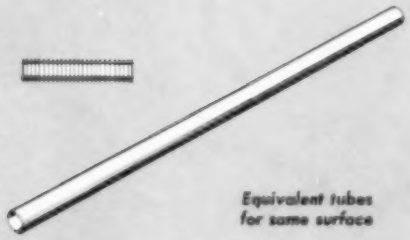
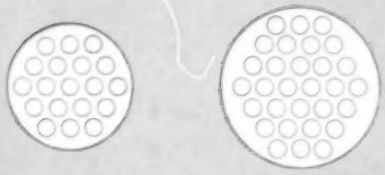
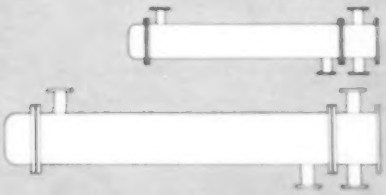


Equivalent tubes for same surface



Fewer tubes mean smaller shells



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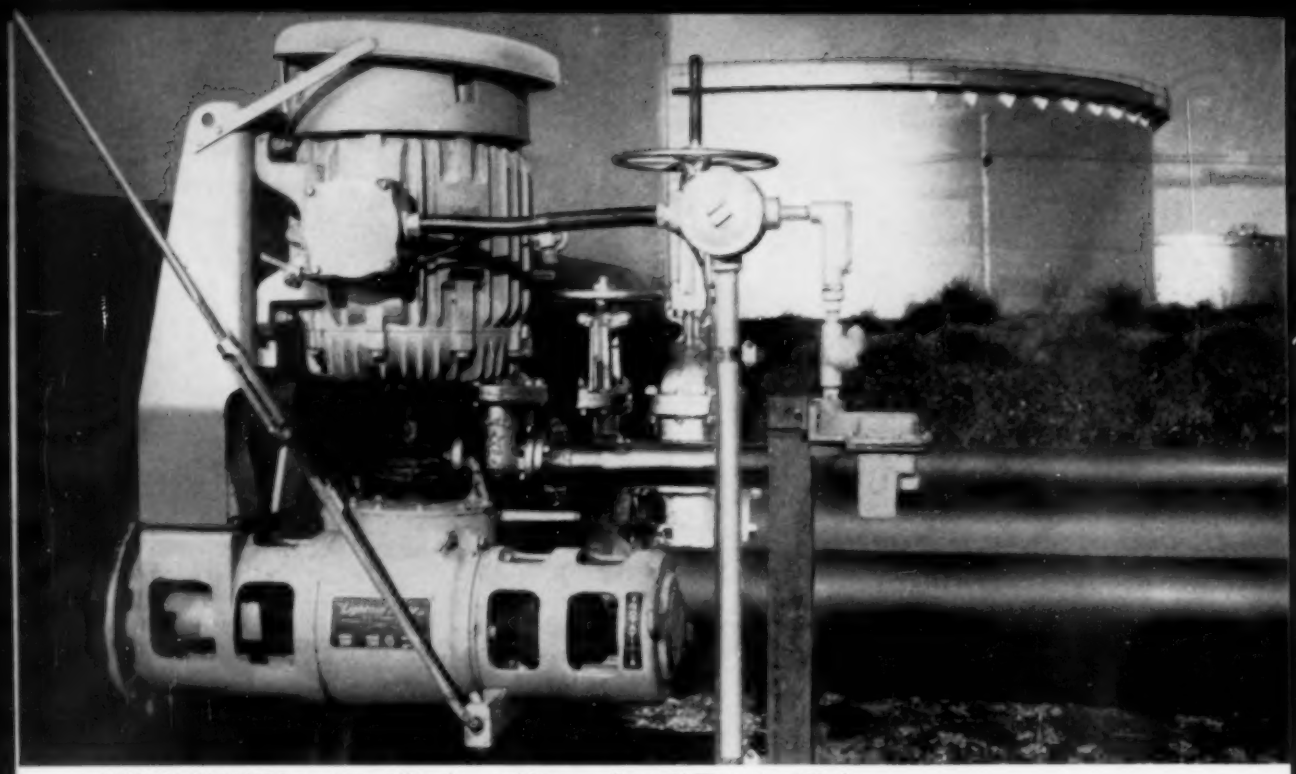

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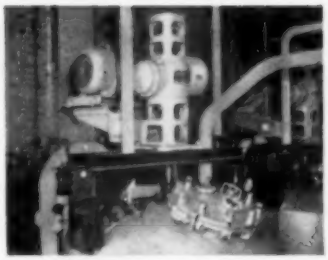

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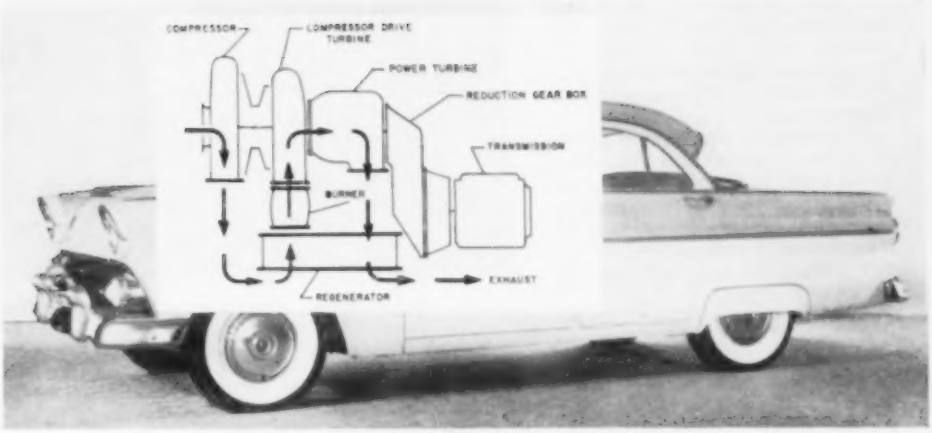


A GAS TURBINE FOR AUTOMOBILES?* Part of the answer to . . .

What Next in Motor Fuels?

A Staff Analysis by the Editors of PETROLEUM PROCESSING

MORE volatile gasoline may be the solution to two important problems facing the petroleum processing industry today. The result of fast-moving and highly significant developments in automotive and aircraft engine design, these problems were brought into sharp focus during the annual meeting in January of the Society of Automotive Engineers in Detroit. They are:

1—How to provide more of the kerosine type fuels for jet and gas turbine type engines.

2—How to meet the continually increasing demand for higher octane by conventional piston type engines.

Spelled out in specific trends, this could mean:

- More kerosine per bbl. of crude throughput, for components of the fuels for the gas turbine engines.
- More volatile premium gasolines, processed by stripping out the heavier ends and greater use of the lighter ends, such as butane.
- A steady rise in octane ratings, some premium grades up to 100 by 1960, to meet rising compression ratios.

The sights are on higher volatility for this reason. Gasoline volatility can be increased by chopping out the higher-boiling components, thereby reducing engine deposits and cutting down on octane requirements for any given car. At the same time, this would make available more of the lower cuts from the crude, which are needed for turbine and jet fuels. The value of gasoline volatility has been boosted by the lessening of the vapor lock problem through improved engine and carburetor design.

The question in Detroit is no longer IF gas turbines will power passenger cars but WHEN? General opinion is that the fuel will be kerosine or a blend of kerosine and heavy gasoline, at least in the early stages of commercial development. There is considerable opinion in both automobile and oil company engineering circles that turbines will be powering cars on the road in five years. A key speaker at the SAE meeting said:

"Over recent years the petroleum industry has been investing $400,000,000 annually in refining equipment to supply modern lubricants and high octane gasolines. Rapid, industry-wide conversion to turbine-powered cars and trucks will make a great deal of this equipment obsolete long before the end of its useful life."

Whether the speaker was referring to economic or technological obsolescence was not brought out. Refiners know the difference.

The basic advantages of gas turbine engines—greatly reduced weight and overall fuel economy as compared with the piston engine—have been big enough to stimulate competitive experimental work by General Motors, Chrysler, Packard, and Ford. First details of the Ford program were

* With a 1955 Ford Fairlane Crown Victoria as decorative background, the schematic diagram shows how regenerator uses hot exhaust gases to preheat incoming combustion air in Ford's gas turbine design.

made public at the Detroit SAE meeting. A. H. Beaufrere, who directs the gas turbine work at Ford, concluded his report:

"The results of our work are encouraging and inspire us to accelerate our efforts in the development of the automotive gas turbine."

A basic handicap to an automotive gas turbine has been its poor fuel economy at part load, Mr. Beaufrere brought out, and part load conditions are the principal operating range of passenger cars.

A solution is seen in the experimental work at Ford and other companies which has led to the incorporation of a regenerator in the engine (see illustration). In this design, air from a compressor is preheated by the turbine exhaust gas prior to its entering the burner.

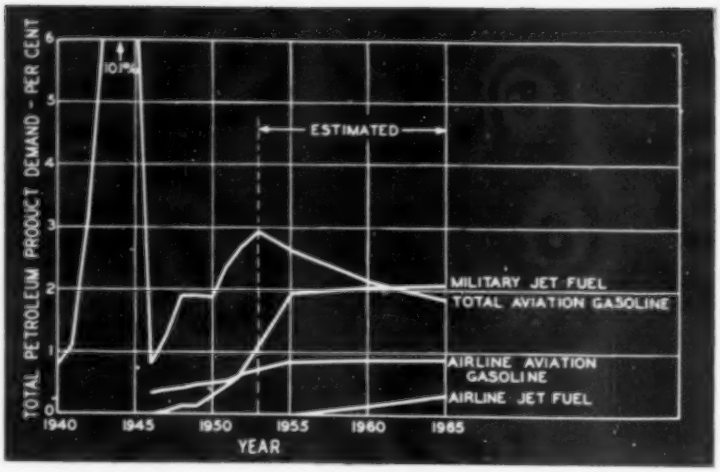
"If a regenerator with high effectiveness is added to a simple cycle gas turbine operating at comparatively low temperature and low pressure ratio," said Mr. Beaufrere, "the fuel economy is greatly improved, particularly in the speed range of 20 to 60 mph. . . . The key to the achievement of a successful automotive gas turbine power plant is the development of high efficiency broad range components (in the fuel) and effective regeneration."

An additional service provided by air preheating, it was brought out, would be to remove the extreme heat from the exhaust gas, which might be at least a nuisance objection to the operation of gas turbine powered automobiles.

If the gas turbine is to burn kerosine or kerosine type fuels (kerosine and heavy gasoline blends, for example), what might this mean to the refiner? Under the best circumstances, this product represents a relatively small cut of the crude oil being processed.

The refiners' market for kerosine is already responding to the requirements of the Armed Services for jet aircraft fuels, about 25% of which is a kerosine component. Jet fuel demand for the first 10 months of 1954 was over 38,000,000 bbl., more than twice that of the same period the previous year.

On the civilian aircraft side of the picture, Capital Airlines will put into service this year 60 new British Vickers Viscount turbine propelled airliners, and Trans-Canada Airlines 25 of the same type of engine. These power plants will use kerosine or JP-4 fuel, of which kerosine is a component. These will be the first time turbo-prop engines will be used in civilian air transport in this country, and the trend is believed to be toward greater use. General Motors has announced as now available for commercial aviation its Allison Turbo-Prop engine, already in extensive use in military aircraft.



DEMAND TRENDS for aviation gasoline and jet fuels, 1940-1965

Demand will be small, however, from civilian air transport for the new types of fuels for some years to come. Jet fuels for this market alone should not cause a significant change in the supply of other liquid petroleum fuels through 1965, E. J. McLaughlin and J. A. Bert, California Research Corp., told the SAE meeting.

The present civilian aviation gasoline demand is less than 1% of the total U. S. petroleum product demand. The airlines' jet fuel demand will probably be less—0.2% in 1960 and 0.3% in 1965. (See chart.) However, by 1960 the combined military and commercial airline jet fuel demand will equal the total for aviation gasoline.

Type of fuels for commercial aircraft driven by the new engines have narrowed down to three, McLaughlin and Bert brought out. They are kerosine, special low-freezing point kerosine, and Military Jet Fuel JP-4. Their principal characteristics are shown in Table 1.

Some of the requirements for automotive gas turbine fuels are similar to those for aircraft turbines. They should: 1) have high combustion efficiency, 2) produce low combustion chamber deposits, 3) reduce turbine wheel deposits and corrosion to a minimum, and 4) have low enough vapor pressure and adequate viscosity for good performance in small pumps.

The view of the airline operators was represented by Paul E. Lamoureux, Trans-Canada Airlines, in his SAE paper. He said that the early development and operation of aircraft turbines was done with kerosine. It was chosen, he explained, because of its relatively low cost and cleaner burning qualities than furnace oils. It was thought that the inherently simple combustion process of the engine would not place any restriction on fuel chemistry.

"However," he said, "the rapid development of the engine and its extensive use in aircraft has shown that ordinary 'kerosine for the lamps of China' was not good enough."

When more rigid specifications were drawn for kerosine for this use, it was realized, Mr. Lamoureux said, that with existing refinery equipment and available crudes, the quantity of suitable kerosine which could be produced fell short of the foreseeable demand of extensive fleets of aircraft, especially in the event of all-out emergency conditions.

The objective of the past few years has been the development of turbo fuel specifications insuring satisfactory performance and also availability. With the purpose of providing the lowest cost fuel that would be suitable and also available in sufficient quantities for an all-out war effort, specifications were set up for the JP-4 fuel (a wide cut gasoline).

"At the present time," said Mr. Lamoureux, "the choice of fuel for commercial turbo aircraft is limited to kerosine and the JP-4 wide cut fuel. It is possible that further development of power plant and airframes will eventually make heavier fuels—such as gas oils or Diesel types—possible or desirable choices. This is not likely to be realized for several years to come."

The way off the hook then for the refiner facing the problem of potential growth in kerosine demand may be in the current simultaneous development of a need for more volatile gasoline for the higher compression ratio automobile engines of the piston type.

This needed volatility is obtained by stripping out the high boiling point fractions, to the extent of about 10% of the total volume. In other words, the 90% distillation point is cut back to about 300° F. The primary purpose in this procedure is to remove components which have been found to contribute most to the combustion deposits in the engine and thus reduce engine octane requirements—at least in the opinion of a number of oil company technologists. Esso Standard Oil Co. and Gulf Oil Corp., as well as perhaps some others are now supplying this type of fuel commercially.

Esso's experimental work was described in a paper at the SAE meeting. The new and improved motor lubricating oils have been effective in helping minimize the contribution of the lube to engine deposits, it was stated. It appeared that further reduction in deposit formation could most readily be achieved by improvements in the fuel. The report goes on:

"The most likely point of attack appeared to be a critical study of the hydrocarbon structure of the fuel. It is well known that for a given hydrocarbon series, thermal stability decreases with increasing molecular weight. In many applications, the decreased thermal stability of the higher molecular weight material is accomplished by increased carbon formation.

"It was therefore reasoned that elimination of these thermally unstable materials would result in lower deposits. The most practical way to accomplish this would be the elimination of the high boiling portion of the fuel."

The two premium type gasolines used in Esso's field experiments were: one of average back-end volatility, with 90% evaporated at 347° F., and a more volatile fuel with 90% evaporated at 302° F. Both fuels contained approximately 50% catalytically cracked stocks and they were made from the same refinery streams and by the same processing techniques in the same equipment. They differed only in that about 10% of high boiling components were omitted from the more volatile fuel. Both blends contained 2.5 cc. TEL/gal. and had nearly the same antiknock qualities. Characteristics of the two fuels are shown in Table 2.

Table 1—Typical Properties of Kerosine, JP-1 (Low Freezing Point Kerosine) and JP-4

Inspection	Kerosine	JP-1	JP-4
Gravity,° API	43.0	42.2	52.1
Dist. Temp., °F.			
10% Evap.	380	345	220
50% Evap.	435	378	324
90% Evap.	480	437	421
Reid Vapor Pressure, lb.			2.5
Freezing Point, °F.	−20 to −40	<−76	<−76
Vis., Kin., −40° F. cs		8.29	3.68
Sulphur, Total, Wt.-%	0.40	0.79	0.74
Aromatic Content, Vol.-%	10	14.3	11.9
Heat of Combustion, net			
Btu/lb.	18,600	18,556	18,714
Btu/gal.	126,000	125,800	119,900
Flash, Tag. Closed Cup, °F.	135	110*	−54*

* Calculated.

Table 2—Fuel Inspections of the New Volatile Premium Grade Gasoline and of a Gasoline of Average Volatility

Characteristic	Volatile Fuel	Fuel of Avg. Volatility
TEL Content, cc./gal.	2.50	2.52
ASTM Distillation (D + L)		
10% Evaporated, °F.	122	118
50% Evaporated, °F.	190	218
90% Evaporated, °F.	302	347
Research Octane No.	95.8	95.2
Motor Octane No.	85.5	85.1

The experimental work included road tests in which the two fuels were evaluated in eight 1953-54 model cars, with overhead valve engines and automatic transmissions. The oil used was a multi-viscosity SAE 10 W-30 grade. The cars were driven in city and suburban type driving over 6400 miles. The majority of the cars came to deposit equilibrium by 2400 miles, as measured by octane requirements. In terms of equilibrium octane requirements all the test cars showed an advantage for the volatile fuel of 2 to 4 octane numbers. The Esso report stated:

"These data demonstrate that the octane requirement increase contribution of the fuel can be substantially reduced by the elimination of the higher boiling, thermally unstable hydrocarbons. This fuel development is at least equal in importance to the development of the multi-viscosity lubricant.

"For the first time a practical method of reducing the fuel contribution to combustion chamber deposits has been found. It is recognized that the magnitude of the improvement obtained by the elimination of the higher boiling fractions is probably influenced by the hydrocarbon type of the materials eliminated."

Gulf Oil Corp.'s higher volatility gasoline is somewhat similar to that being marketed by Esso in that the 90% distillation point is cut back to around 300° F.

In the case of both companies the new higher volatility premium fuel has been brought out without changing the characteristics of regular grade.

Utilization of butane by refiners to provide greater front-end volatility in their motor gasolines is growing and will increase further when arbitrary limitations in the state fuel inspection laws are changed. Socony-Vacuum Oil Co. technologists reported to the SAE on their studies in the relationship between vapor lock in vehicles and fuel volatility. In their work experimental fuels of higher front-end volatility than those normally sold were marketed under summer conditions in selected areas of the country. The trial marketing period corresponded with a period of high temperature.

"The observations of trained field engineers indicated no noticeable change in performance or customer acceptance of the experimental fuels," the report stated. "Observations of employe cars, of fleet operations and of service station customers all indicated complete satisfaction with the product."

Discussions of the findings in the Socony-Vacuum report by other oil company representatives brought out

that Sun Oil Co., Esso Standard Oil Co., and Standard Oil Co. (Indiana) are among those who are increasing the proportion of butane in their motor fuels to the extent that present vapor pressure limitations and other conditions will allow.

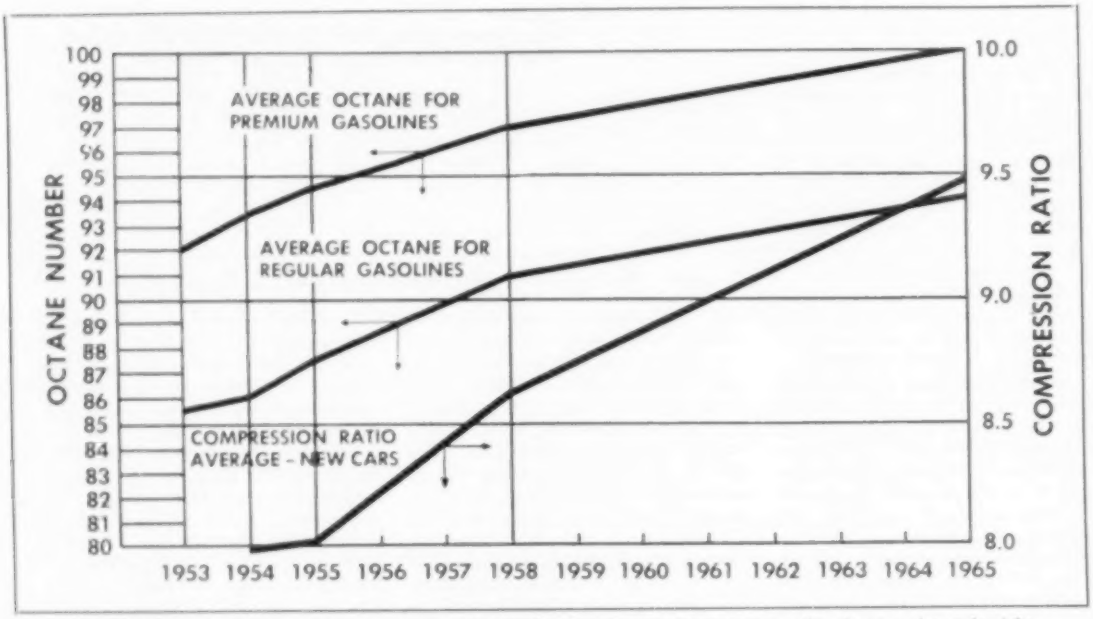
R. E. Barnum, Esso Research and Engineering Co. (formerly Esso Laboratories of Standard Oil Development Co.), compared the results of a survey of vapor locking characteristics of postwar automobiles with those of the Socony-Vacuum survey. The Esso study showed that a Reid Vapor Pressure increase of 1.2 units is possible for the average gasoline marketed at ambient temperatures of 85° F. The Socony-Vacuum data showed that, at 100° F. ambient temperature, an increase of at least 1.3 units in RVP is possible for the average fuel.

"The tolerance of passenger cars for fuels of higher front-end volatilities than are currently being marketed is believed due to the efforts of car manufacturers in recent years to improve automotive fuel systems," Mr. Barnum stated. "Beneficial changes include carburetors of new design and improved fuel pumps. Also, the routing of fuel lines away from engine hot spots has been helpful. The improvements are evident in 1955 models."

More volatile motor gasoline can be sold in many areas of the U. S. with safety, provided a proper control procedure is used for setting vapor pressure limits, the Socony-Vacuum report brought out.

"Reid Vapor Pressure alone is *not* an adequate procedure for controlling vapor locking tendencies," it was stated. "In fact, some gasolines of normal vapor pressure have a higher vapor locking tendency than other gasolines of above normal RVP.

(Continued at top of next page)



THE PICTURE FROM NOW TO '65 for average fuel quality and new car compression ratios shows no let-up in sight

Octanes and Compression Ratios Still Up

THE 10:1 compression ratio piston type automobile engine may be introduced in small numbers as early as next year, because the high anti-knock quality fuels can be made available to operate them satisfactorily.

This was the indication of a survey made by PETROLEUM PROCESSING among petroleum and automotive industry technologists both at the recent annual meeting of the Society of Automotive Engineers in Detroit and since that time.

The upward trend in octane numbers for premium gasolines will be along the same pattern. With some oil companies already selling premium grade of 98 research number, it is possible that a 100-octane fuel will be launched by 1958 or 1959. Refinery economics may not immediately justify the cost of manufacturing, but the advertising value will be high to the first oil companies to take the plunge.

These are estimates on how soon *peak* qualities of fuel and engine compression ratios may hit the national scene. The picture for *average* conditions are shown in the curves above.

By 1965, for example, the average premium gasoline being sold may well be 100 research octane number and the average compression ratios of new cars about 9.43:1, with a 12:1 compression ratio engine coming along.

The rate of gain in octane numbers, however, will probably be slower than it was from 1950 to 1955. The slowdown will reflect the higher rate of manufacturing fuels as octane numbers approach 100 research. Another

"The production of more volatile gasolines will save money for motorists. In some areas, however, arbitrary restrictions prevent the refiner from making these savings available. To help overcome this situation, the American Society for Testing Materials and the Federal specifications for motor gasoline should be altered to include a more realistic control of the vapor locking tendencies of motor gasolines."

Sun Oil Co. has marketed fuels of higher front-end volatility for some time now and its advertising through the fall and winter stresses that butane is a component for quicker starting. "Our field service organization has not encountered fuel handling troubles in the 90° F. plus range," E. F. Marshall, Sun automotive engineer told the SAE at Detroit.

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"An Exploration of the Automotive Gas Turbine," A. H. Beaufrere, manager, gas turbine dept., Scientific Laboratory, Ford Motor Co., engineering staff, Dearborn, Mich.

"Commercial Turbine Fuels — An Approach to Their Selection," Paul E. Lamoureux, Trans-Canada Airlines, Montreal, Que.

"Control of Engine Knock through Gasoline and Oil Composition," C. L. Fleming, Jr., N. V. Hakala, L. E. Moody, R. W. Scott, and C. O. Tongberg, Esso Research and Engineering Co., Linden, N. J.

"Passenger Car Vapor Lock," D. P. Heath, and R. H. Thena, Socony-Vacuum Oil Co., Inc., and Gilbert Way, Ethyl Corp.

"Comments on Paper on Passenger Car Vapor Lock," R. E. Barnum, Esso Research and Engineering Co., Linden, N. J.

All above references are to papers and discussions presented at the annual meeting of the Society of Automotive Engineers, Detroit, Mich., January 10-14, 1955.

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factor may be the growing attention given to reducing or eliminating combustion chamber deposits from both lubes and fuels. This work will reduce the octane requirements of engines in service on the road, and the higher antiknock quality fuels may not be as acutely needed. On this point, Esso Standard Oil Co. investigators reported to the SAE meeting:

"Based on presently available data, it appears that it will be entirely feasible to operate 9.5:1 and 10:1 compression ratio cars on 98-99 octane (research) fuel of the proper volatility, using a multi-viscosity lubricant. Furthermore, in these high compression ratio engines, with conventional fuels and lubricants, the antiknock quality of the fuel would have to be 100-octane or more to meet the high octane requirements caused by conventional fuels and lubricants."

Regular grade gasoline is also expected to rise along with the premium during the next decade (see graph), hitting an average of about 94 by 1965. However, some factors seem to indicate that the two-grade fuel system might disappear by that time. If this happens, the average octane rating for any single fuel would be slightly under 100.

Several factors enter the picture as possible reasons for this possibility. By 1965, the percentage of fuel sold as premium grade will probably hit 43%, up from 31.7% as of now. Conversely, the percentage of regular grade will drop from its present 68.3% to 57% in 1965.

Although it is expected that refinery improvements will continue the next 10 years, there is current speculation as to whether the economics will make it profitable to continue producing regular grade as its share of the market drops downward.

As demand for regular drops, refiners may no longer be able to produce a volume sufficient to permit the sale of regular grade at 2 to 3¢ under the price of premium. They will either have to boost the price of regular as the octane goes up, or keep it the same and boost the premium price to make up the difference. This will widen the price spread between the two grades. In recent years, marketers have already been doing this, particularly on the East Coast, to absorb the added cost of making better quality fuel.

This change in demand for the premium fuel presents the refiner with these three alternatives:

1—Slow down on the quality improvement of regular grade in order to keep down costs and prices.

2—Keep pace with the premium grade and boost its price to recover the added costs this approach would cause.

3—Go to a single grade fuel which would be designed to satisfy all cars on the road.

Car makers might support the one-grade fuel solution to the problem. One automobile manufacturer already has indicated he would not be averse to lowering the octane requirement of his higher priced cars so that currently they could be satisfied with a 93-94 octane fuel.

Refiners, however, would likely resist the idea. One major refiner sees such a shift to one grade of fuel in anything less than 10 to 15 years as an injustice to the motoring public. He points out it would force thousands of car owners to pay a premium price for a high octane gasoline for cars that could be operated satisfactorily on lower octane.

It will not be until practically all cars which now can be satisfied with regular grade gasoline are eliminated from the highways, this refiner says, that such an injustice can be avoided. He also explains that too many oil companies have equipment now to produce low octane rather than high octane gasoline to expect them to make a shift at any time in the near future.

"As we see the handwriting on the wall," he said, "car manufacturers will still be after higher octanes for years to come."

Whether or not the one-grade fuel ever comes, the octane differential among various regions—East Coast, Gulf Coast, and Midwest—seems destined to be eliminated in the next few years.

High octane Gulf Coast gasolines are already moving into the Midwest, for example. As this volume grows, competition will continue to force the refiners in the Midwest to meet the octane quality of the Gulf Coast products. The steady growth in use of octane-producing process equipment, like catalytic reforming, is a strong factor in this situation.

If the automotive gas turbine comes as soon as some authorities expect (see preceding article), the entire fuel projection could go out of focus. It won't mean the end of premium gasolines, but it will cause some revisions in future planning.

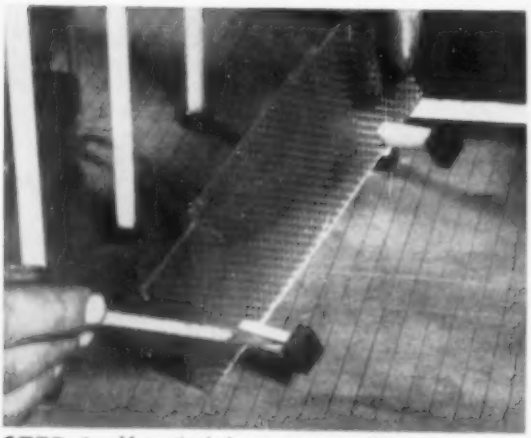
For example, if the turbine were introduced as early as 1960, it might mean that plans to go to 100 octane could be abandoned completely. From that point on, octanes might remain stable for an extended period during the transition from piston to turbine engines.

But until the gas turbine becomes a reality, it appears inevitable that premium gasolines will grab a constantly growing proportion of the gasoline market.

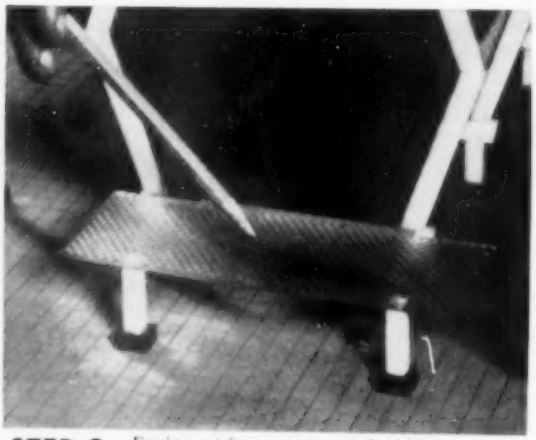
Parco President Parker (right) and assistant Weisser—photo by Chemical Week

"DO-IT-YOURSELF" plant process model is assembled and then . . .

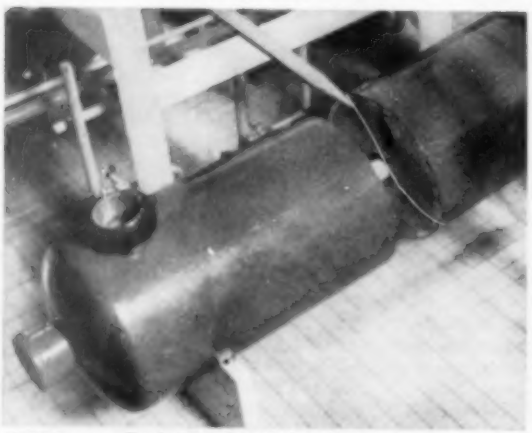
Can YOU Save Design Hours with



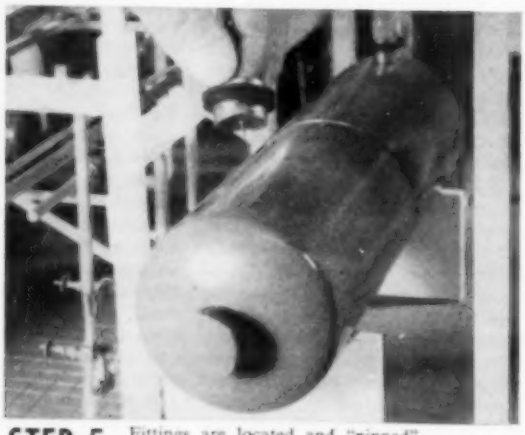
STEP 1 Magnetized bases are assembled onto the proper equipment items



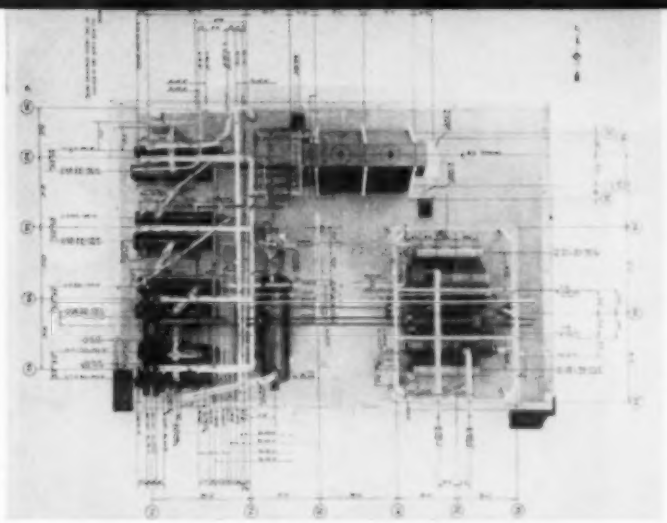
STEP 2 Equipment items are magnetized in place onto the metal grid board



STEP 4 Equipment length is adjusted by adding or removing filler pieces

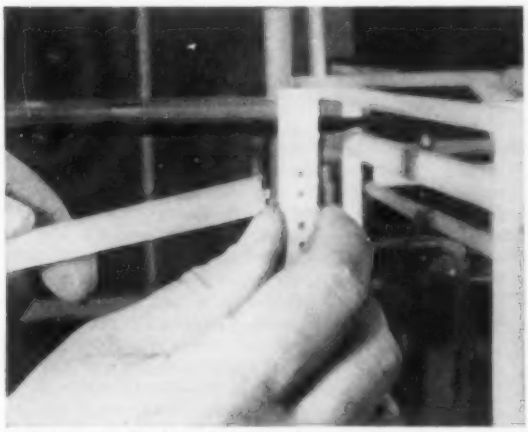


STEP 5 Fittings are located and "pinned" onto soft wood equipment models

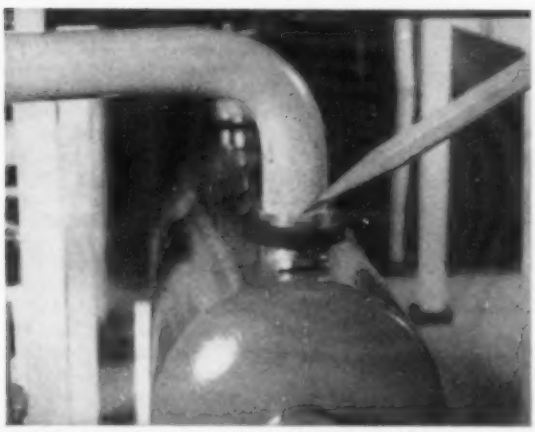


. . . PHOTOGRAPHED AND DIMENSIONED

'Photo Blueprints'?



STEP 3 Horizontal structural members are installed onto vertical members



STEP 6 Piping is cut to length and inserted into the proper equipment fitting

By ROBERT L. DAVIDSON
Assistant Editor

WOULD you like to construct your own scaled plant models for new construction projects, and simultaneously reduce your engineering design manhours by 25 to 40%? Jack Parker, president of Parco Co., Inc., is confident that their newly developed "PDQ" prefabricated plant model kit and photographic "blueprints" can do just that.

Finding themselves faced with problems of increasing need for rapid engineering designs, Parco began the development of an entirely new concept in combined model-making and design-drafting. The result of their study is the PDQ "erector set" type of scaled plant model kit. This model can be assembled by the design engineer himself, then photographed and dimensioned as shown above.

More than a year ago, Jack Parker, and his staff had the idea that scale plant models should be a means to an end, not just the end result. In other words, the model should aid the design engineer in formulating his design, not just prove the design once it has already been placed on paper and blueprints.

To accomplish this, the design engineer himself must be closely identified with the model's progress at all steps, and the model must progress at least as rapidly as his design. Going one step further, why not have the design engineer himself make the model?

Conventional model making is a highly skilled profession requiring special techniques and knowledge not associated with the majority of design engineers. For the design engineer to become a model maker, conventional methods of model making had to be discarded, and an entirely new approach found.

The answer was developed and tested for over a year, culminating in the PDQ kit, an adaptation of a simple child's toy familiar to all—the erector set. Instead of the standard series of wheels and flat structural members, the Parco staff designed an entire line of scaled process equipment, structural members, pipes, and fittings.

Aware that they could never hope to anticipate each and every piece of specialized equipment, they developed new methods for constructing special items required by users of their PDQ model

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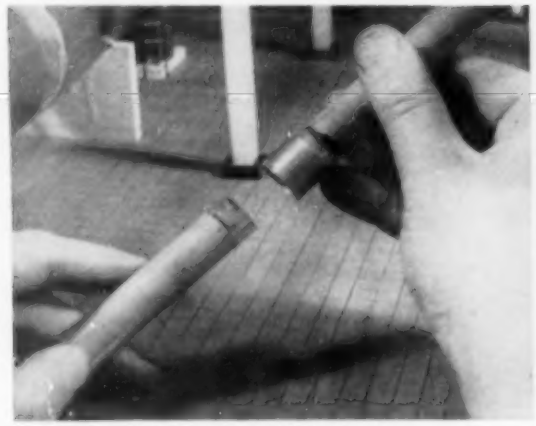
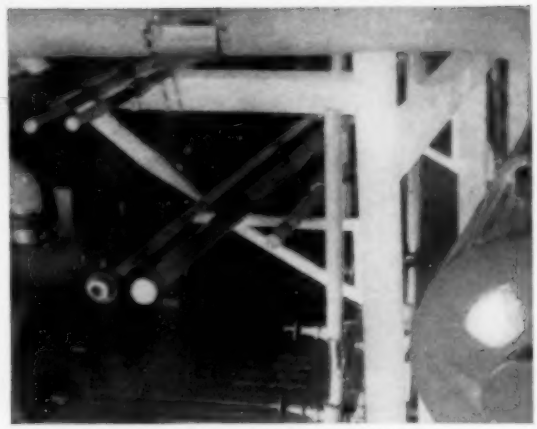


STEP 7 Piping sections and bends are connected by removal "sleeves"



STEP 8 Pipeway supports are attached to the vertical structural members

Want Faster Design? *Try 'Do-it-Yourself' Plant*

kit. Now Parco can furnish any special model requirement, scaled and complete, at nominal sums within 24 hours of the request.

How Does PDQ Work?

All that is required by the design engineer as he builds the PDQ plant model is the process flow sheet, and information relating to the plot plan and equipment types and dimensions. Further design modifications can be incorporated in the model as they are developed.

A specially prepared metal covered plywood base—available from small to large sizes—serves as the base for the model. On the base, grid marks are scribed to indicate the scale of the model.

Standard equipment item models are furnished to scale representing piping, bends, offsets, fittings, valves, structural members, vessels, tanks, platforms, manholes, nozzles, grid boards, etc.

Scaled vessels of soft wood are supplied by Parco representing increments of one foot diameters through all standard sizes required. All lengths are furnished, with fillers to shorten or lengthen the vessel as required. Dished heads are separate, and can be added after deciding whether the vessel will be installed horizontally or vertically.

Vessel saddles and foundation supports are of magnetized metal, holding on to the metallic surface of the grid board base. The bottoms of the supports have small projecting lips so that toolmaker's clamps can be applied to secure the model during shipment.

Pre-cut platforms are provided as round, half-round, square, rectangular, etc., with magnetized strips attached to the underside.

Manholes, handholes and other access means are provided in scale for all standard sizes with the proper flanges mounted on solid tubing from which a short pointed nail projects.

All piping is of easily cut acrylic tubing, scaled to represent either insulated or uninsulated diameters. Valves and fittings either snap into place on pipes, or have pins to allow sticking into place on the soft wood equipment items.

Items which are considered special include furnaces, compressors, unusual tanks, specially designed equipment, etc. Parco constructs scale models of these items upon receipt of equipment drawings.

Erecting a PDQ plant model requires the following procedure.

The design engineer collects necessary information concerning the process flow sheet, the plot plan and equipment types and dimensions. He then orders the model kit, sending drawings for models of special items.

STEP 1—Upon receipt of the kit, the design engineer places the metal grid board on any drafting table or other convenient location. He then selects the proper equipment supports which have magnetized bases.

STEP 2—The equipment supports are placed in their proper locations on the metal grid board onto which the equipment support magnets are held.

STEP 3—Vertical structural members are selected and positioned. Horizontal structural members are easily cut to length, and have small projections fitting into evenly spaced holes in the vertical members.

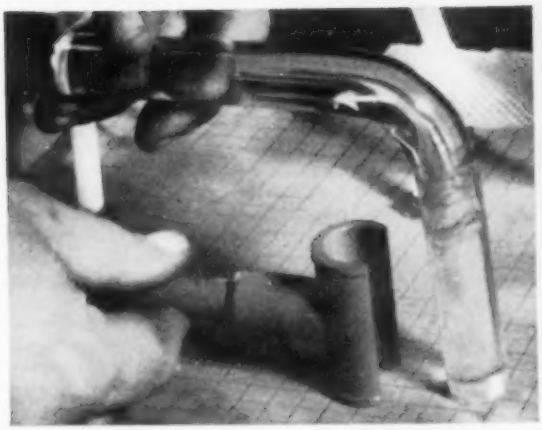
STEP 4—Cylindrical equipment

Who Is Parco?

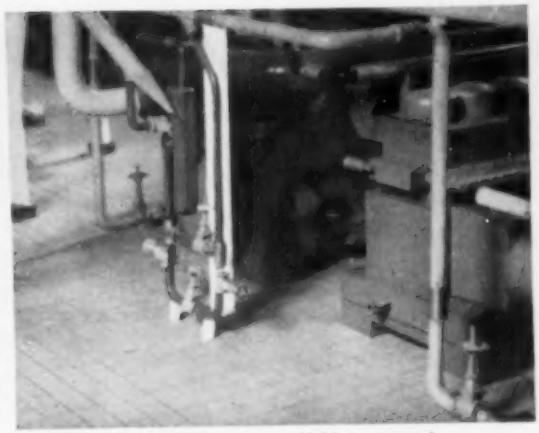
The Parco Co. is a New York design consultant company. They are not model makers, and they are not engaged in equipment fabrication or construction work.

Parco does make and sell the PDQ kit, and does contract engineering design work for petroleum, chemical and industrial projects. Though they are relatively new—formed in 1947 as a successor to a similar firm organized in 1940—they have performed engineering design in the petroleum, petrochemical, and chemical fields for construction having a value in excess of $400,000,000 during the past three years.

Since design is their major commodity, Parco has found it essential to be familiar with the "tricks of the trade" in order to compete with other design companies, and render a worthwhile service to companies who have their own design sections.



STEP 9 Valve models are "snapped" into place on the proper piping section



STEP 10 Prefabricated manifold or control stations are installed on the board

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Model and 'Photographic Blueprints'

items are in sections connected by a piece of dowel. Fillers may be added or removed to alter the length of the item.

STEP 5—Scaled fittings with projecting pins are selected and "stuck" into the desired location on the soft wood equipment models.

STEP 6—Piping sections are inserted into the proper fitting.

STEP 7—At this point, the design engineer must decide at what locations he will need to obtain elevation views of the finished model. Along these selected lines piping will be installed so as to "break" during the final photographing of the model by connecting piping sections with fitted slip "sleeves."

STEP 8—As the installation of the piping progresses, the need and location for pipe supports and pipeways becomes evident. The vertical supports are held on the grid board magnetically, and cross-members attached.

STEP 9—Standard scaled valves and fittings are "snapped" onto the proper pipe, or "stuck" into place on the proper piece of equipment with a projecting sharp pin.

STEP 10—Pre-fabricated manifold and control stations are located on the model.

STEP 11—Platforms are placed in position by pushing supporting nails into place on the item of equipment onto which the magnetic bars on the underside of the platforms are held.

STEP 12—Underground pipeways and other construction are assembled as in the preceding steps by the use of a special recessed grid board construction.

How Is the Completed Model Used?

The design engineer now has a completed model. If there are design changes, he merely moves the magnetically held equipment and supports, cuts the piping to the new length, clamps or pins a valve in a new position, or adds or removes a filler piece on an item of equipment.

The photographed completed PDQ plant model shown at the beginning of this article is for a typical refinery process consisting of the furnace, compressor, heat exchanger, drum and yard areas.

The model can be shipped, if desired, to another location. To do so, the equipment items are secured in position by means of small toolmaker's clamps which fit over the projecting lips present on all items where they contact the metal grid board.

Even though the completed model has served the valuable functions of reducing design manhours, and assisting the design engineer in visualizing his design as he worked, it still has the disadvantage of being a "physical" model without exact dimensions or construction instructions.

Next the model is photographed. Plan view photos are obtained from an overhead position, and elevation views are obtained by photographing from the desired side. Cross-sectional elevation views are made by progressively removing the portion of the model in the way of the desired internal view. This procedure has been simplified by the design engineer's previous determination of where he would want to obtain elevation views (Step 7), allowing an even break in the piping at this location.

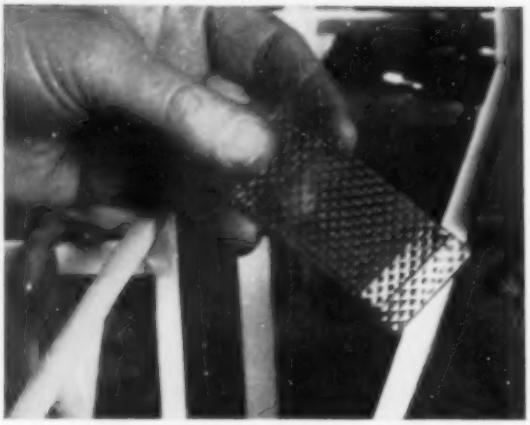
Special photographic techniques are employed to eliminate a confusion of shadows on the finished photograph.

In order to prevent excessive parallax around the edges of the finished photograph, the model is photographed in sections which are then connected to make the final over-all plant picture. As many as 25 to 50 photos may be used to make an entire plan view for a large plant.

Dimension lines are inked onto the large transparent negatives resulting from the photographing procedure. The completely dimensioned photographic plan view of the previously mentioned refinery process is shown at the beginning of this article.

Small design changes are easy to incorporate onto the photo negative directly. Inked lines can be removed or added as desired. Small equipment or process flow line changes can be added by ink directly onto the negative, then another positive made. However, extensive revisions should be made to the PDQ plant model itself, which will then be re-photographed.

Isometric drawings are needed in addition to the photos for piping details. Using the model and the dimensioned photographs, the design engineer proceeds to draw conventional



STEP 11 Platforms are "magnetized" to nails pushed into wood equipment models

Why Was PDQ Developed?

Engineering and design departments are under great pressure to furnish more rapid engineering plans and data. These pressures are met by practicing shortcuts and time saving techniques. However, the supply of new shortcuts is almost nonexistent.

Three-dimensional models—through an improvement over paper designs—have met with objections of cost, getting information off the model, and locating the model so that all concerned can obtain information from it.

PDQ philosophy is based on the premise that a plant design usually will require changes as it develops. PDQ takes these changes in its stride with the removal of a few pins, cutting plastic tubing, moving magnetically attached equipment, or relocating valves and fittings.

detailed isometrics for the desired piping arrangements. Ordinarily the time required for standard isometrics is 5 hours per line with product take-off. Parco has found that by using the PDQ model to help, only one hour per line with product take-off is required.

Objections to Models

According to Jack Parker, the problem faced by all plant model advocates is one of education. Old-timers contend that they have no need of a toy to understand a drawing. Construction superintendents complain that the shiny new model in their shack turns the operation into a sideshow, with everyone having a spare half-hour crowding in to look at the curiosity.

Conventional scaled plant models are expensive, costing as much as $20,000 to $50,000 for a $10,000,000 plant. Also the company's time and engineering must be furnished at every step during the construction of the model.

Some companies would rather not disclose all of the details of their process to an outside organization with the chance that this information will be passed on to others either directly or indirectly.

Furthermore, Jack warns that it is not possible to scale accurate dimensions off of any model, but likewise accurate dimensions cannot be scaled off of the average standard blueprint.

PDQ Advantages

The members of Parco believe that their PDQ plant model kit answers all of the general objections to scaled plant models. A three-dimensional model is ideal for members of management and others who are not adept at interpreting detailed drawings.

It is not necessary to send the PDQ to the field. Unlimited copies of the dimensioned photographs can be distributed to those persons directly concerned with the construction of the plant.

"What about parallax?" is a question often heard by Jack Parker. His answer is that construction men say they like parallax—as long as it is not excessive. Parallax lends a "three-dimensional" quality to the otherwise flat picture.

Cheap engineering design—usually 25 to 40% lower than by conventional design methods—is possible when using the PDQ model. Not only is much of the drafting work eliminated, but that which is needed—isometrics and dimensioning—can be completed more quickly when using the model. A design engineer need spend much less time in mental visualization and false starts when he has an actual three-dimensional model before him, than when he is trying to do everything on paper. A typical comparison of PDQ and conventional design methods given by Jack Parker is shown in the table to the left.

PDQ Improvements

Not completely satisfied with the present PDQ model kit, Parco is continuing to work on refinements and improvements. In the mill are three new procedures designed to enhance the usefulness of their technique.

Dimensioned stereo-pair photos have been developed and are now in patent proceedings. The technique is simple, yet allows the field user to have a three-dimensional view of the model—complete with properly ori-

Cost Comparison of Conventional and PDQ Engineering Design Techniques

	Conventional Procedure	PDQ Technique	Saving from PDQ
Pipelines to be drawn	300	300	
Number of men used	8	4	
Calendar time for above men, weeks	17	12	30%
Total manhours required	4350	1650	
Total cost—equip. & piping drawings	$24,000	$14,500*	40%*

Note: * This does not consider that the PDQ technique results in a model which is essentially free. An equivalent conventional model would have cost $20,000.

ented dimension lines—without being encumbered by the actual model.

Stereo-pair photography is an old art, but getting the dimension lines on the photos to stand out in their proper locations is new. Parco finally developed a relatively simple method of superimposing isometrically drawn dimension lines on a transparency over one of the stereopair transparencies. The result is strikingly realistic, combining a three-dimensional plant view with three-dimensionally placed dimension lines.

Cross-sections inside buildings will soon be possible by the use of specially sectioned models for the building and its equipment. Each floor level will slide off of the next lower one, exposing the equipment and lines below. In this manner, a progression of plan views may be photographed down through the building, from top to bottom.

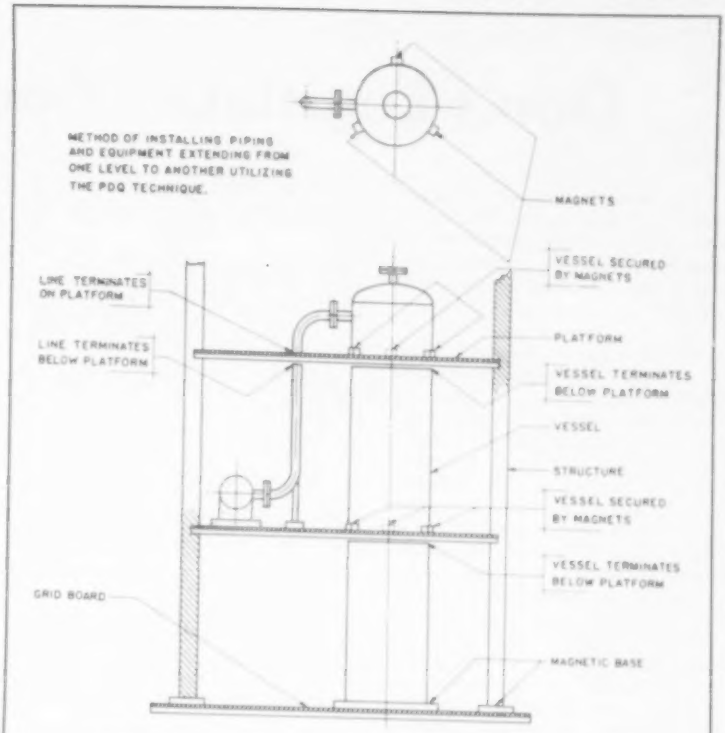
Complicated equipment and piping arrangements will soon be furnished in models that come apart, layer by layer. Piping around the unit will also "break" at these junction points. As in the case of the building models, progressively lowering plan view cross-sections may be photographed on this unit.

Parco is, of course, not alone in this burgeoning new field of process and plant scale models. A number of the larger engineering companies as well as refining company engineering departments have been building their own models for some years.

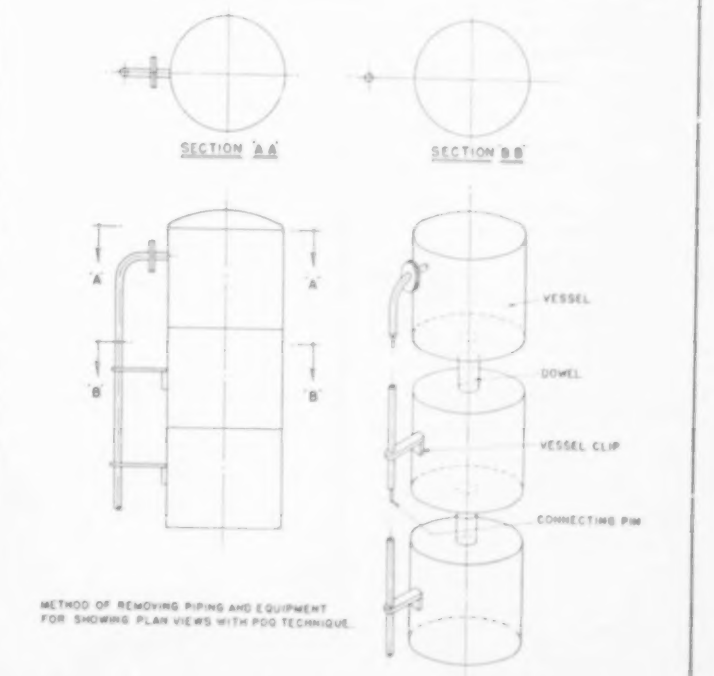
In addition, a number of other private firms have gotten into this field. For details on one of them, Industrial Models, Inc., of Wilmington, Del., the reader is referred to an earlier PETROLEUM PROCESSING article, "Models Can Cut Your Piping Costs," by William N. Troy, Feb., 1954, pp. 224-226.

Jeff Bowen, president of Industrial Models admits that he too has been investigating the use of plant model photographs as a basis for engineering drawings. Bowen, however, feels that photographic techniques have limitations due to equipment congestion and parallax distortion in pictures covering large areas. He feels that the idea has some possibilities, but that kinks must be resolved before the photographic method will have general applicability. (*Chemical Week*, Dec. 18, 1954, page 74.)

Jack Parker of Parco feels that he has the congestion problem whipped by using models that can be easily disassembled into sections. Parallax, Parker says, is mitigated by taking pictures of relatively small areas and fitting them together to make the overall picture.



SECTIONALIZED BUILDING models allow cross-section photographs



SECTIONALIZED UNIT and piping models for cross-section photographs

Cleveland's Smog Formula—

Don't Legislate—Cooperate

"Legislation as such will never prevent air pollution. The only way to meet the problem realistically is through a joint and cooperative approach by municipal and industrial leaders."

By WILLIAM TROY
Cleveland News Bureau

THESE words by Howard J. Scott, Cleveland's commissioner of air pollution control, have become the progressive philosophy of that city's joint government-industry attack on air pollution. The first step in their campaign has started to pay off dividends. It is a detailed study of local weather in relation to concentrations of air contaminants, which has been under way since 1949. Though the study is by no means completed, it has nevertheless produced these solid results:

- A much better working knowledge of how concentrations of air pollutants can be influenced by weather. City air pollution officials now feel they can predict favorable or unfavorable weather conditions for pollution disposal a day in advance.
- Working liaison between municipal air pollution officials and area industry. The two groups have come to recognize the problem as one to be solved by the community, and not one for political debate or personal bickering.

The study may eventually give officials enough knowledge to predict weather conditions a week ahead of time. Then participating companies like Standard Oil Co. (Ohio), with a refinery in the heart of Cleveland, will be able to schedule fume-producing operations well in advance.

"We'll be able to utilize the atmosphere itself in combatting air pollution," was the way a Sohio technician put it.

Much still has to be learned before such long-range forecasting can be done, but the strides since 1949 have been considerable. Up until that year the city air pollution division had been acting more or less like a traffic cop, lecturing air pollution offenders and making suggestions, when violations arose, about abatement devices and ways of minimizing emissions.

But there was no concerted effort to find how atmospheric conditions affected emissions from industrial plants. Yet both city officials and industrialists realized that weather had a tremendous effect.

For instance, on some days the SO_2 fumes arising from the Standard Oil Co. (Ohio) acid sludge-treating unit at the No. 2 refinery would quickly rise and be dissipated. On other days of the same temperature and wind velocity the fumes would cluster closely around the refinery.

Finally in 1949 the city's air pollution control division conducted a four month meteorological-air pollution study in the shallow Cuyahoga river valley, which splits the center of Cleveland and contains most of its heavy industry.

About all this study showed was, in the words of one valley industrialist, that "a huge area of unknowns existed." He continued, "We realized that what was needed was not an abatement study for practical remedial measures, but a pure research program which would tell us why we could put out heavy fumes one day and bother no one, and put out a piddling amount the next day and get all kinds of complaints."

City air pollution people put the results of their preliminary study squarely up to industry. A meeting was called of 14 large companies, many of them located in the Cuyahoga valley area. The city told top management it wanted to make a detailed study of weather and air pollution conditions in the valley with three specific aims:

1. **To correlate** the meteorological data with air pollution counts.
2. **To determine kinds of weather** favorable for retention and dispersion of air contaminants.
3. **To make it possible** to forecast the concentration of contaminants from weather data.

There was one difficulty, they said.

How Sohio Pitches in to Beat

DATA COLLECTION is the first stage. Here mechanic Steve Sanislo maintains a windvane and anerometer at one of Sohio's stations.

The city's air pollution control department didn't have the money or the manpower to carry out a study on this scale. Wouldn't industry take part of the burden, since air pollution was a community problem?

There's no record of the reaction this caused, but of the 14 companies represented in the original meeting, 11 finally agreed to take part in the program. Those with facilities in the valley were Standard of Ohio, with one refinery in the valley and one in the general area, American Steel & Wire Div. of the U.S. Steel Corp., the Du Pont Co., Harshaw Chemical Co., Jones and Laughlin Steel Corp., and Republic Steel Corp.

The others were Cleveland Electric Illuminating Co., Industrial Rayon Corp., Thompson Products, Inc., Willard Storage Battery Co., and Aluminum Co. of America.

Industry didn't swallow the whole pill with one gulp. It took several meetings in 1949 and 1950 to iron out all the details of the program, the financing, and the responsibilities of the participants. One thing industry wanted to make sure of was that the program would stick to pure research —not tie in directly and immediately with recommendations for remedial measures. But industry liked the overall idea, not only because it gave them a chance to prove their community-consciousness, but because each was tired of often being blamed for air pollution really coming from some other plant. A sound statistical study, they felt, would go far toward placing responsibility where it belonged without ruffling feelings in neighboring companies.

Each participant agreed to contribute money to purchase the necessary meteorological and air-sampling equipment. Price of the meteorological equipment alone for each station ran to around $3000, says Commissioner Scott. And air-sampling apparatus came to about $350-500 more per unit. In addition, the companies were to furnish the manpower to run the stations and make immediate pollution analyses of the air samples taken. In most cases, immediate responsibility for the company's work lay with a chemical process engineer, plant safety director, or some other person.

Wind direction, wind velocity, temperature, and relative humidity were the meteorological facts to be measured. Sulfur dioxide, hydrogen sulfides and fluorides were originally chosen as the air contaminants to be charted.

It was soon found, however, that SO_2 was the easiest substance of the three groups to sample; it showed the most even distribution and existed in measurable quantities. Moreover it showed a close proportionate relationship to what is known as the "soiling index"—the stain which appears on filter paper treated with air samples. For these reasons SO_2 concentration was adopted in 1952 as the criterion of air pollution.

The U.S. Weather Bureau agreed to take part in the program and to supply some of its own equipment. It offered to recommend proper sites for location of instruments, set up supplemental meteorological stations in outlying areas, and contribute data such as pressure, precipitation, and cloud cover and types.

By early 1951 the network of "reading" stations was well under way and had this set-up:

• Four U.S. Weather Bureau meteorological stations were put up to record temperature and relative humidity of the lake, lakefront area, downtown Cleveland (at the 600-ft. level of Cleveland's Terminal Tower),

Air Pollution

IN ADDITION to its contribution to Cleveland's joint government-industry smog effort, such as the weather sampling work shown in these photographs, Standard of Ohio has spent some pretty big money on its own hook. Here are the company's recent expenditures for reducing air pollution at its Cleveland refineries:

Scrubbing plant and additional equipment; revisions to No. 1 catalytic cracker to reduce plume discharge	$65,000
Asphalt plant fumes eliminator equipment	$96,000
Boiler house controls to minimize gas to flare	$25,000
Grease plant fog filter at No. 2 refinery	$62,000
New flare stack at crude stills	$120,000
Total	**$368,000**

It should be emphasized that these expenditures do not include costs involved in data collections nor do they include capital investment in new process units designed inherently to reduce pollution.

WET-BULB AND DRY-BULB TEMPERATURES are checked over by Robert Joyce, instrument man at Sohio's No. 2 refinery

WIND DIRECTION and velocity are checked on anemograph by Sohio technician

POLLUTION and weather data punched on IBM cards are run through the sorter

and on the far west side in a park area approximately eight miles from the Cuyahoga river valley.

• Seven meteorological and air-sampling stations were set up in the valley proper and manned by industry.

• Three more industry-manned meteorological stations were installed on the far east side.

• Two municipally manned meteorological and air-sampling units were also set up, one on the west rim of the Cuyahoga valley, the other at the air pollution control division's downtown laboratory.

One company, Thompson Products, did not maintain a station but contributed financially for equipment in some of the weather bureau stations.

Synchronized sampling began in January, 1952 at all the stations on a one day (24 hours) per month basis, with each station air sampling on the hour and making continuous meteorological observations, which were automatically recorded as to time of day. The air-sampling equipment used in these first studies was the standard USPHS impingers. But the analytical time needed in using this equipment was long. Officials at Sohio, for instance, which had a meteorological-air-sampling station at the No. 1 refinery and meteorological stations at the No. 2 (lube) refinery, found they were using about 48 man hours a month to make the necessary preliminary calculations before the material could be forwarded to the air pollution control office.

So city technicians set about developing an automatic impinger that took samples every hour and channeled them automatically into an attached rack of test tubes. Also, about this time sulfur dioxide was adopted as the sole criterion of pollution. Because of the two developments the research teams were able to switch to a five-day-a-month testing schedule. Sampling was carried on for one work week out of every month, from 9 a.m. on Monday until Friday at 4:30 p.m.

Howard J. Scott took over the job of commissioner in mid-1952. In the meantime, a vast accumulation of figures was piling up in the air pollution control office, for it was turning out to be more work than the staff could handle in addition to their regular daily assignments. Scott's first step was to hire a full-time meteorologist, Ralph E. Rhode, to assist in statistical and graphical analysis. Even so, the paper work continued to mount and it soon became evident that some other means of tabulation would be necessary. Again industry stepped in, set up a fund of some $1500, and IBM was called in to select, tabulate, and total all data. A major share of the IBM work was done by the correlations group of Sohio's technical service department. They were experienced in statistical quality control tabulations and had the equipment on hand.

The IBM card material, individually compiled for each observing station, was tabulated and then sent back to Scott's office for final analysis. In 1953, periodic reports of a preliminary nature were sent by the air pollution control office to the cooperating companies. Included were the IBM tabulations covering the period of March, 1953, to March, 1954. Shortly after this last compilation, a confidential report on the results was forwarded to the companies and agencies cooperating. This was later made public in a paper Scott delivered on November 28, 1954, before the American Society of Mechanical Engineers.

With better than two years' tabulated work under his belt, Scott now feels he can say with safety these things about the Cleveland air pollution situation:

1. Accurate predictions of weather favorable or unfavorable to pollution dispersion can be made 24 hours in advance with the statistical data and forecasting methods now in hand.

2. No serious condition should develop or continue to build up over Cleveland for more than 8 to 10 hours at one time, because of a constant imbalance in temperature between Lake Erie and the land and the resultant cross-winds.

Observations have shown that on at least one occasion northern Ohio was experiencing a prevailing southerly wind of 35 miles an hour, yet had a brisk northerly breeze blowing off the lake and moving three or four miles inland, under the warm, rising air. Scott states that such a temperature imbalance, which creates cross-winds, could lead to serious pollution, except for the fact that the land around Cleveland is relatively flat, providing none of the natural "pockets" often found in mountainous areas.

The greatest single influence on sulfur dioxide concentration, the reseachers found, is wind direction. Taking the center of the industrial area as the mid-point, concentrations increase downwind and decrease upwind, regardless of whether the wind is moving north to south or east to west. Velocity, though, has no apparent effect—either on concentration or horizontal distribution. Temperature and the concentration of SO_2 tend to have an inverse relationship—the higher the temperature, the lower the content of SO_2 and vice-versa. Scott explains this in layman's language by saying that cold air is denser and does not permit thermal mixing. Temperature variation during the day has the same effect. The highest concentrations of SO_2 are apparent early in the morning, the lowest in the mid-afternoon—assuming of course that those periods are the day's low and high temperatures.

Temperature inversions have a varying effect on air contaminants, depending on wind direction. An inversion exists when the higher air is actually warmer than ground air, forming a "roof" through which warm gases find it hard to penetrate. During an inversion, if the observation point is downwind from the source of SO_2, the concentration of gas will be higher at that point than is normal for that wind direction. Put the observation point upwind from the source and there won't be any appreciable change from the normal concentration. Generally, it was found, any prolonged wind over an area where there are no sources of contamination will lower the concentration of SO_2, regardless of inversion.

The tests showed that the annual mean concentration of air pollutants, in terms of sulfur dioxide, for the Cleveland industrial area is 0.166 ppm. This varies from 0.265 ppm. in the winter to 0.109 ppm. in the summer. Frequency distribution charts indicate that the average concentration of sulfur dioxide in the industrial area is less than 0.200 ppm. 84% of the time.

Scott's office developed a forecasting procedure from the collected data. It is based on a table or chart showing mean SO_2 concentrations with each wind direction, correction factors for diurnal variations, correction factors for inversion influences, an accurate wind direction forecast, and a forecast of the time occurence and duration of inversions. In over 100 tests, Scott's men found that their predictions were correct, plus or minus 0.060 ppm. 95% of the time.

In the near future, Scott hopes the program can be broadened, with further industrial support, to provide more air sampling in outlying residential areas and sampling stations atop Fenn College Tower (200 ft.) and Terminal Tower (600 ft.).

Scott does not feel that the conclusions reached are by any means final. Nor does he believe they are necessarily applicable in any other area except Cleveland. "Air pollution is exclusively a district problem," he says. Of one thing he is perfectly certain, that industry's participation was decisive. "I'll be frank about it," he says, "without industry's manpower and money, we just couldn't have done the job."

Five methods for . . .

Injecting Petroleum Additives

By LAWRENCE LOWY
Petroleum Division
B-I-F Industries, Inc.

METHODS for injecting additives into petroleum products vary widely. They can, however, be broken down into five rather broad classifications:

1—Constant Flow Injection
2—Flow Proportional Injection
3—High Rates of Injection
4—Dry Additive Injection
5—Gravimetric Injection Control

In any additive feed system, consideration must be given to the form in which the compound is to be injected. For purposes of economy, it is wise to reduce handling operations to a minimum from the time the material is received to the point where it is added to a product. However, because of such factors as cost of handling equipment, safety, viscosity, corrosion, etc., it is often necessary to convert the additive from the form in which it is received.

Liquid additives received in drums can be rolled into a convenient horizontal position and, by means of flexible connections, fixed to the suction of the feed pump. This is extremely practical if the material is not too viscous and if feed rates do not require changing of drums too often.

If injection requirements are too minute or if viscosity presents a problem and heating is not practical, it may be well to dilute the additive and make up a stock solution. This also aids in mixing the additive with the product, for as it is injected it is already partially diluted. In addition, accuracy requirements are somewhat reduced when stock solutions are used.

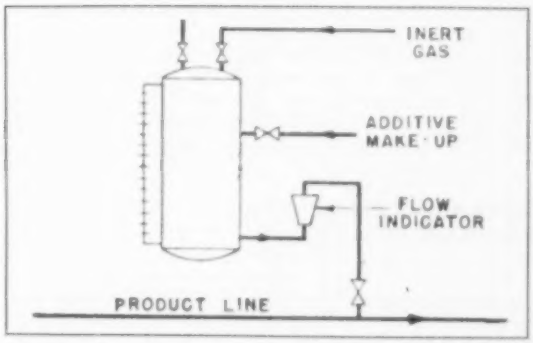
Volumetric feeders can be accurately checked for quantities fed by mounting additive supply tanks on scales. Weights can be read at regular intervals and checked against pump capacity settings.

1-Constant Flow Injection

The first method of additive injection is that in which a liquid additive in the form of a concentrate or a stock solution must be injected into product lines operating at constant or near-constant flow rates.

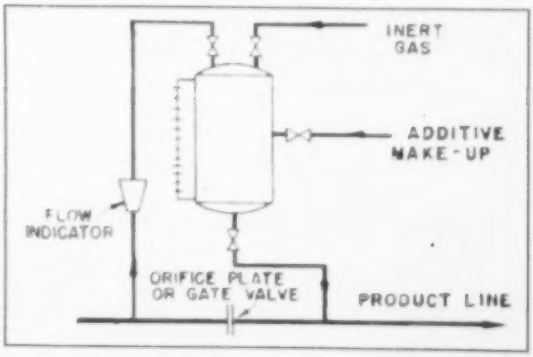
Motor Operated Positive Displacement Pump

For the positive displacement pump injection system illustrated in the sketch to the right—standard injection pumps are available having capacities of from 5 cc/min. up to 40 gpm. Each size of injection pump is adjustable over a 10 to 1 capacity range. On-off operation for the positive displacement pump injection system can be controlled manually, or with the use of a product line pump interlock switch adjusted to automatically start the injection of additives at the same time that the product line pump starts operating. Timer control can also be utilized on this type of injection system.



Gas Pressure or Blowcase System

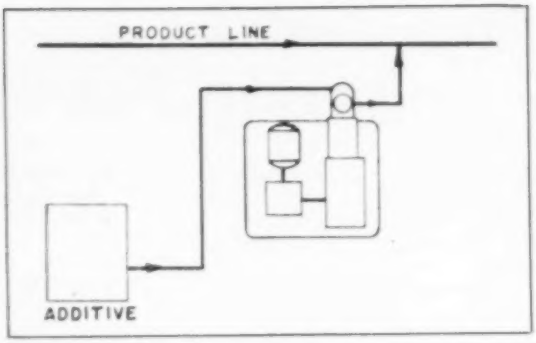
An alternate method to the motor operated positive displacement plunger pump technique described above is illustrated in the sketch to the right. For the injection of additives into product lines in situations where the accuracy of injecting additives is unimportant, and the additive compound itself is inexpensive, the gas pressure injection scheme is simple and inexpensive to install and operate. An inert gas blanket is maintained in the additive feed-drum to provide the pressure necessary to force the additive solution into the main product line. Control of the additive injection rate is by means of an area meter and a manual valve adjustment to bring the meter reading to the desired injection rate.



TURN PAGE FOR MORE INJECTION METHODS

Blowcase System with Eductor

Using an eductor eliminates the need for pressurizing the solution tank in the blowcase system. The eductor is operated by a differential pressure produced by a restriction in the main line. The low pressure drop across the eductor throat is sufficient to withdraw solution from the additive tank. Regulating the inlet pressure to the eductor controls the rate of additive withdrawal. An area meter in the additive line confirms valve settings. Compared to the positive displacement method, this arrangement does not produce great accuracy, as pressure stream fluctuations easily disturb the fixed rate settings. Where the eductor inlet pressure is not three times the discharge pressure an eductor pump must be inserted ahead of the eductor.

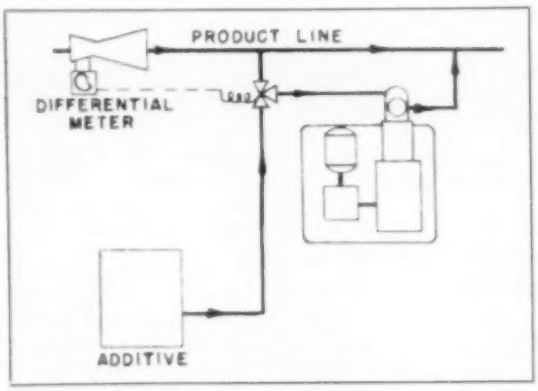


2- Flow Proportional Injection

Flow proportional methods of additive injection are becoming preferred due to greater accuracy requirements and savings from accurate proportions rather than over-adding to insure sufficient additive injection.

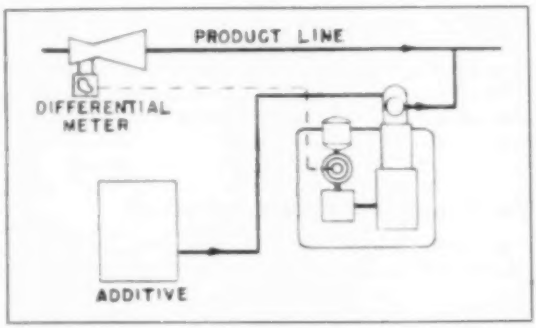
Differential Meter with Electric Solenoid Control

The sketch shows a pacing system to feed additives in accordance with flow variations and yet maintain strict ratio settings. A differential producer, Venturi, flow nozzle, Dall Tube or thin plate orifice, transmits a time duration impulse proportional to the rate of flow. The cycle is normally 15 seconds and, for that portion of the cycle which represents flow rate for that instant, a closed contact signal holds the solenoid valve in the positive displacement pump suction open to the additive supply tank. For the remainder of the cycle, the valve is closed to supply and open to recycle during which period the pump merely pulls product from the main line and recirculates it back into the line. Flow variations will change the time for the solenoid to open to supply the main line recycle.



Differential Meter with Pneumatic Control

If the resulting dwell periods of the main line recycle produce an undesirable effect when using the solenoid in the preceding arrangement, an alternate arrangement can be used. Instead of the electric signal, a pneumatic transmitter can be utilized to deliver a flow proportional signal of 3 to 15 psig air. This will operate a positioner to vary the output speed from an infinitely variable speed changer to the positive displacement pump.



Meet the Author

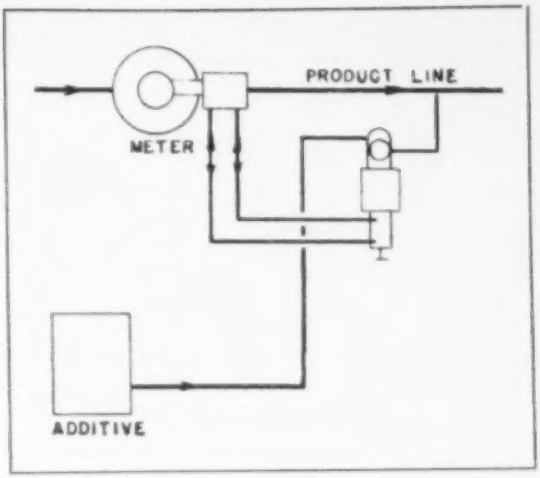
Lawrence Lowy, Regional Sales Manager, Petroleum Division of B-I-F Industries, Inc., received his B. S. in mechanical engineering in 1943 from Rensselaer Polytechnic Institute, and his M. S. from Stevens Institute of Technology in 1950.

Larry served a three year hitch with the Navy during World War II followed by a short job with Western Electric Co.

Since then he has spent seven years with Proportioneers, Inc., Builders-Providence, Inc., Omega Machine Co., et al of B-I-F Industries, Inc. Lowy is a licensed professional engineer in New York State.

Positive Displacement Meter With Pilot Valve

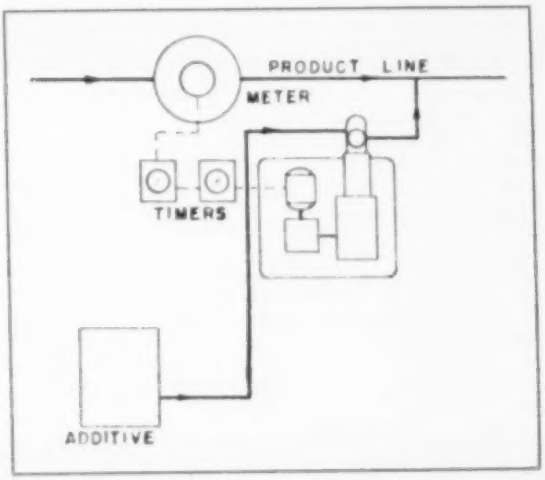
Certain applications lend themselves better to the positive displacement meter rather than the differential type. In this event, a differential injection control scheme as shown in the sketch is used. A positive displacement meter has a pilot valve mounted above it. The meter rotation is converted to reciprocating motion in the pilot valve. This valve merely acts to pilot air alternately to the opposite ends of the impulse cylinder of a pneumatically operated positive displacement pump. Increases in the main line flow will increase the meter rotation proportionally. This in turn increases the pilot valve stroking and, in turn, the pump stroking rate. The initial ratio adjustment is accomplished by a handwheel at the rear of the impulse cylinder. Setting the handwheel establishes the stroke length by regulating the rearward travel of the impulse piston. Arrangements of this type are used primarily for additive rates up to 2 gpm. The method for higher rates is covered later.



Positive Displacement Meter With Electric Contactors

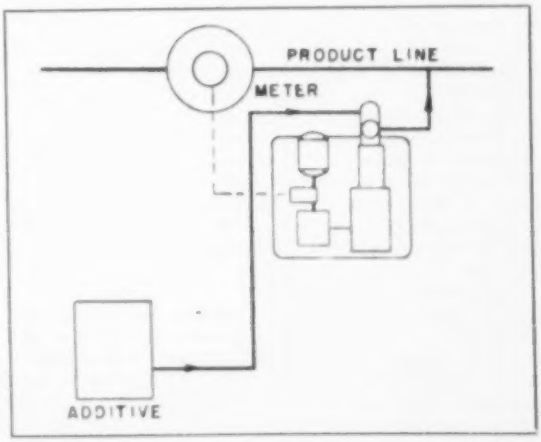
For this arrangement, as illustrated by the sketch, a timer receives and accumulates the signals, each of which indicate a complete meter spindle revolution representing the rated gallonage throughout for that revolution. The timer trips a second timer when a preset number of contacts, representing the desired gallonage, have been received. The second timer will operate the motor driven positive displacement pump and will control start, duration of operating cycle, and stop. Another accumulation of meter contacts renews the cycle.

This same scheme can be used with a differential meter and time duration transmitter of the type previously described. In this case, the timer will be operated on a preset time accumulation rather than contact basis. That portion of every 15 second cycle representing flow will drive into the accumulator. When the preset time period has been accumulated a second timer is energized thereby duplicating the steps described previously.



Positive Displacement Meter With Electric Contactors And Solenoid Clutch

Another positive displacement meter additive injection arrangement uses the electric contactor technique. However, it also includes a solenoid clutch control on the positive displacement additive injection pump as shown in the sketch to the right. This electric contactor can also be operated from an integrator on a differential meter installation. The solenoid clutch is inserted between the additive injection pump motor and the speed reducer and is energized from the electric contactor signal. When the solenoid clutch is engaged, it will produce one cycle of the additive injection pump. A trip mechanism prevents the solenoid clutch from over-riding and starting a second injection cycle into the main product line. Normally the solenoid clutch idles while the additive injection pump motor operates continuously.

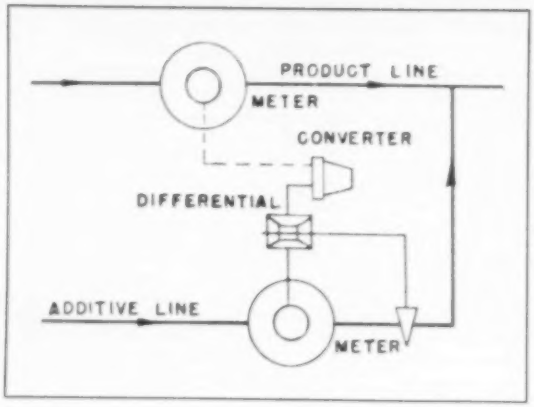


TURN PAGE FOR THREE MORE INJECTION METHODS ⇒

3-Injection Rates Above 2 GPM

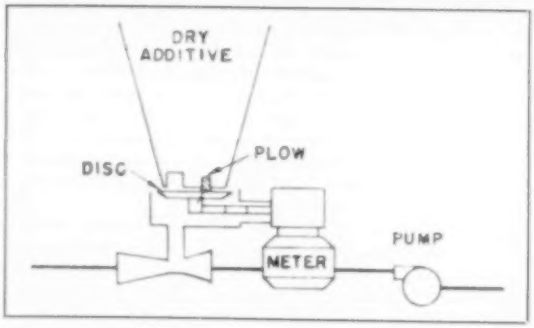
As indicated previously, additive injection rates above 2 gpm are better handled by a different method. This involves the use of positive displacement meters for both the main line and the additive line.

Again an electric contactor on the main line meter transmits contacts or pulses to a differential control. These pulses provide an interrupted rotation to one side of a differential unit. Additive flow through the secondary line meter, also equipped with a contactor, provides an opposing rotation to the other side of the differential unit. A spider gear riding the opposite rotating input gears will travel away from the control point should the opposing gear speeds vary. This movement is transmitted mechanically to a control valve in the additive line to bring the additive metered rate back in line with the main line flow signal. This device is supplied for fixed ratios, but change gears are provided and installed in a matter of minutes should ratio requirements change.



4-Vacuum Injection of Dry Additives

Often it is necessary to inject dry additives, instead of making the powders into stock solutions of varying concentration. The sketch indicates a flow proportional method in which a Venturi section in a product line will produce sufficient vacuum to draw in the dry material delivered from a rotating plate. Material is fed from a hopper above the plate and as the plate emerges from under the hopper it passes through a variable orifice which establishes the ratio. The plate is driven from a positive displacement meter located alongside the feeder. An increase in the flow rate will produce a proportional increase in the rotational speed of the plate.



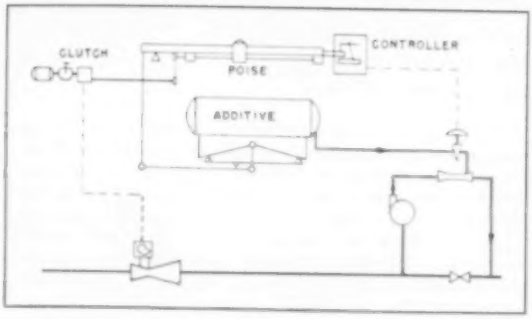
5-Gravimetric Control of Injection

Gravimetric additive feeding is not widely used, except for tetraethyl lead. However, with the increasing use of special additives and economies from superfine controls, this method should receive increasing attention for solids and liquids.

The sketch illustrates the scheme used for TEL. It can be adapted to other additives. A differential meter and transmitter in the gasoline line sends a time duration impulse proportional to the flow to the clutch mechanism in the scale beam cabinet. Energizing the solenoid clutch for some part of every 15 second cycle drives the chain and sprocket assembly and the beam screw to retract the movable poise.

The retraction rate is set to give the desired TEL to gasoline ratio. Beam deviations resulting from poise retraction cause movements of the beam tip linkage connected to an air controller. The pneumatic controller output signal positions a diaphragm control valve in the TEL line to the eductor and establishes correct TEL flow rates. This system incorporates safety devices to shut off TEL should conditions become hazardous.

A variation on this system—not illustrated—provides a dual gravimetric unit. When one unit is feeding to the product line, the same control that establishes feed rate also controls the filling of the second gravimetric unit from a supply hopper. When the level in the first unit reaches a set minimum, an automatic reversing action takes place. The second unit commences feeding to the main line and the first one goes on refill.



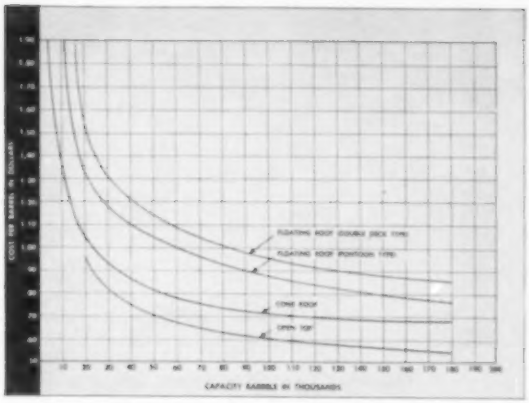


FIG. 1—Costs of tanks per bbl., by type of roof

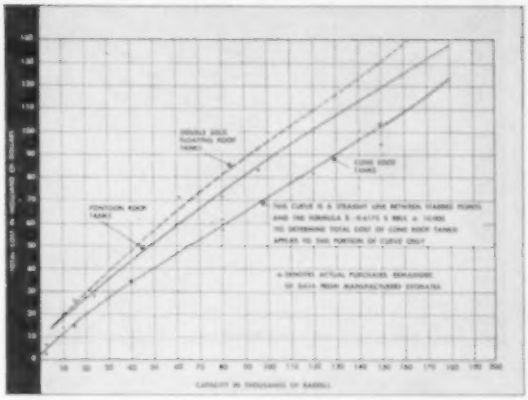


FIG. 2—Total estimated cost of tanks, by type

Protect Your Tank Investments

How to control annual costs by careful selection, erection, maintenance, and well-timed retirement

By C. V. LYNN
Sinclair Refining Co.

WHAT factors can help you control annual expenses on your refinery tankage? There are at least five, the way Sinclair Refining Co. looks at it. The yearly charges as well as the initial investment can be safeguarded by:

- Selecting the best possible design and type of tanks, including accessories.
- Paying close attention to tank foundations and following careful erection procedures.
- Providing adequate maintenance, including painting.
- Inspecting regularly and keeping thorough records on corrosion.
- Taking the tank out of service as soon as it has reached the end of its optimum useful life.

Why pay such close attention to tank age? Take Sinclair as an example. The more than 26 million bbl. of gross storage capacity the company has occupies an estimated 75% of total refinery property, and represents a tremendous capital investment. In addition, the value of stored products is likely to be considerably greater than the tank investment figure.

A clinching argument, just on the matter of foundations alone, is this: The foundations of any building that cost $100,000 would receive a lot of consideration. A tank that costs that much and may hold $1,000,000 worth of flammable product should not receive less.

Sinclair uses two main classifications of tanks—cone roof and floating roof. The cone roof is relatively familiar to all refiners and will not be discussed except in connection with accessories and costs.

In the floating roof class there are several types—pan, single deck pontoon, and double deck. All are basically the same in that they are installed in open top tanks and float on the contents with some kind of a vapor seal arrangement between the shell and the movable roof.

The pan type is cheaper in first cost than the other types. However, it is doubtful that the company will purchase any more for general use because of their instability and other disadvantages.

The double deck roof has a top and bottom deck plate, separated by an air space divided into liquid-tight compartments. Its principal features are:

1—Considerable strength and structural stability.

2—Fair surface drainage.

3—The center or low part of the upper deck is practically always above the liquid level in the tank.

4—It will support a large weight of snow and ice but has a low storage capacity for rain water.

5—Barring serious accidents, it is practically unsinkable.

6—It usually costs more than the other types.

The single deck pontoon roof has a single deck surrounded by a doughnut-shaped circular chamber divided into compartments. Sometimes it will have an additional pontoon in the center. Still another design will incorporate a large center weight to provide better drainage; normally there is no slope and the roof is flat or may even be high in the center.

The only apparent advantage of the single deck over the double deck roof seems to be that it is cheaper in sizes over approximately 10,000 bbl. The single deck roof is flexible and not as strong as the double deck. It will not safely carry the same load of snow and ice and it has a large water storage capacity. Since the center of the

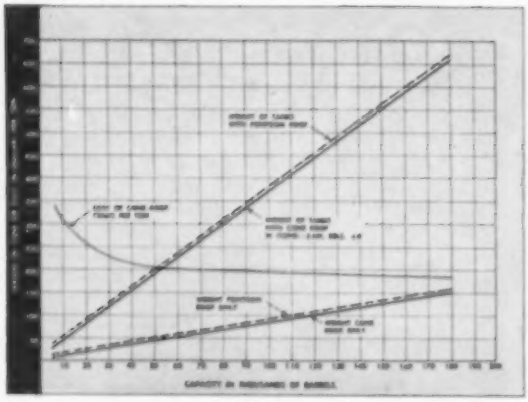


FIG. 3—Weights of tanks according to capacity

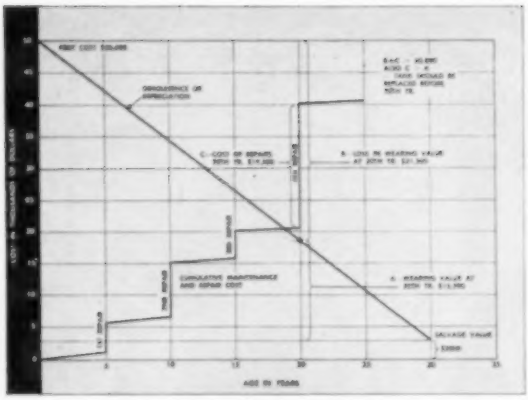


FIG. 4—Economical retirement age for a tank

deck is below the level of the tank contents, under some conditions the tank contents can back up onto the roof unless a hose or a pipe drain is used. The single deck roof does not have the same factors of safety as the double deck.

A sub-type of pontoon roof has a vapor space under a portion of the single deck. The purpose of this construction is to provide a steeper slope than is otherwise obtainable. It also offers a variable volume space for vapors trapped or generated under the deck. The better slope for drainage is somewhat offset by the condition around the center pontoons in roofs of large diameter where water is supposed to flow around the valley to the drain but frequently does not.

There is also at times a disadvantage in the vapor space under the roof, because of the likelihood of corrosion if sour products are stored.

Cost is not much different for this roof than for other single deck pontoon type roofs.

As for vapor loss, no data is available for comparing the double deck and the pontoon roofs. However, it seems doubtful that there is any great difference between the performances of the two. Under conditions of surface boiling, the single deck has a bubble of vapor which is probably as effective insulation as the air space of the double deck. Therefore, the double deck roof must pay off in greater safety, less need for painting, better maintenance record, and longer service life to justify its extra cost.

What do these types cost? The curves shown in Figs. 1 and 2 were plotted from data from several sources. They include erection, but not foundation, dikes, or piping. Some of the figures were submitted by various manufacturers for estimating purposes while others represent actual bid or purchase prices from 1951 through 1953.

In drawing the curves, Sinclair attempted to give a little more weight to the values representing actual purchases. At best, the curves only approximate average conditions and costs of tanks of normal proportions. There are a number of variables affecting costs such as geographical location, climatic and field conditions, labor and material costs, size of the job, and the competition. However, it is believed that the curves point to some trends which might govern selection.

It is quite apparent that, if consistent with manufacturing and operating conditions, the largest tanks are the most economical. It is also apparent that the cost per bbl. of storage rises sharply below about 40,000 bbl., so as to make smaller tanks uneconomical unless limited to such capacities by operating conditions.

It will be noted that in smaller sizes there is tendency toward a convergence in the costs of double deck and single deck pontoon roofs. This fact is supported by information from manufacturers that below about 10,000 bbl, there is not a great deal of difference.

There also seems to be a slight tendency toward convergence in costs of the pontoon and cone roofs in larger sizes. In some cases, it may be that a pontoon roof costs little more or no more than a cone roof. And the advantage of the floating roof is even more apparent if consideration is given to the venting equipment and other cone roof appurtenances plus the fact that the underside with all its framing is particularly vulnerable to corrosion.

The cost in dollars per ton of cone roof tanks is shown in Fig. 3. The weights were taken from manufacturers' published data for tanks having average diameter-height ratios.

Other factors of selection which affect price to a minor extent are factors of size and should be considered when ordering. Choice of a diameter is limited only by capacity desired and ground space. Height is generally limited by available pumping head, supporting capacity of the soil, and economic selection of plate widths.

In the case of plate widths, plates ¼-in. and thicker are readily available in 8-ft. widths, and 3/16-in. plates in 6-ft. widths. Wider plates can be obtained, but the size extras may make them uneconomical. Manufacturers say the most economical tank height is usually one using multiples of the stock widths.

The supporting value of the tank grade is, of course, a variable; but for foundations without piling 3000 lb./sq. ft. seems to be a conservative value. Since this is the weight of 48 ft. of water, it limits tank heights unless the ground is unusually good or unless piling or some other type of deep foundation is used. There are locations where 48 ft. would be excessive, particularly where a large diameter tank is to be built or a number of closely-spaced smaller ones.

In purchasing a floating roof tank, it should be remembered that, due to roof displacement, the full capacity of a cone roof tank of equivalent dimensions is not obtained. If this full capacity is important, it should be clearly specified in the inquiry and order, and proposed design should be examined for this feature.

If floating roof tanks are operated frequently at full capacity, it may be desirable to provide a skirt plate or extension all around and above the normal shell rim.

How to Figure Unit Tank Painting Costs

WHAT is the annual cost of painting a tank and keeping it painted over a definite period of N years? Assume that the tank is painted when new at an initial cost (including surface preparation, etc.), which may be higher than a repaint job. This annual cost may be expressed by the formula:

$$C_a = \frac{C_n + C_r\left[\dfrac{N - L_n}{L_r}\right]}{N}$$

where: C_a = average annual direct unit cost (per 100 sq. ft. = a "square")
C_n = unit cost of initial painting (when new) (per 100 sq. ft.)
C_r = unit cost of repainting at definite periods (per 100 sq. ft.)
N = life expectancy of the tank
L_n = life in years of the initial paint job
L_r = life in years of the repaint job

For example: let $N = 25$ years (assumed).
$C_n = \$11.86$
$C_r = \$6.88$
$L_n = 5.93$ years
$L_r = 5.71$ years

$$\text{then: } C_a = \frac{11.86 + 6.88\left[\dfrac{25 - 5.93}{5.71}\right]}{25}$$

$= \$1.39$ per 100 sq. ft. per year.

Then what is the effect of increased life with incidental increased painting cost? For simplicity assume the life expectancies of the initial paint job and a repaint job to be the same: $L_n = L_r = L$, and $N = 25$ years.

Let x = an increment of added life in years, and
y = an increment of added cost in $ to both a new and subsequent repaint jobs to attain this increased life.

Then, to effect any savings:

$$\frac{(C_n + y) + (C_r + y)\left[\dfrac{25 - (L + x)}{(L + x)}\right]}{25} < \frac{C_n + C_r\left[\dfrac{25 - L}{L}\right]}{25}$$

which, after reduction, becomes: $L_y < C_r x$

For an example: assume $L = 25$ years, and $C_r = 3.65$. If we add an extra coat of paint or some procedure to each paint job that increases L by 3 years, then the most we can pay for such additional treatment to break even is: $y = (3.65 \times 3)/5 = \$2.19$ per square for each paint job.

Or suppose that we add some procedure such as an extra prime coat and more expensive finish coat material, which costs $4.00 extra per square for each painting of the tank. In order to save any money we must get an increased increment of life x to compensate for the increased increment of cost $y = \$4.00$. Therefore, $x = (5 \times 4)/3.65$, or 5½ years, and $L + x$ must be greater than 10½ years.

This will contain the seal shoe and provide a better seal against evaporation due to windage when the tank is full.

Without such a device, the seal shoes project above the tank and the area in contact with the shell below the liquid level is much reduced. If there is a secondary seal, it also is inoperative and may be damaged when the roof descends.

This skirt must have slotted holes or openings of some sort all around at the design height of the shell. Otherwise, if the liquid level rises beyond this point, the lower shell rings will be overstressed. There is some objection to the use of a skirt plate with slotted holes on the basis that the tank is more likely to be over-run because the seals are below the top and invisible. The validity of such an objection depends upon methods of operation.

Fittings should be specified properly when any type of tank is purchased. They have considerable effect on successful tank operation, and improper specification may lead to later charges for extras and/or dissatisfaction with operation.

A few dollars saved on initial cost by eliminating needed fittings or using inferior equipment is usually poor economy. Once a tank goes into service, it may be several years before the desired fittings can be installed and even then the downtime and extra cost of making the tank safe for welding may preclude installation.

Several choices of drainage devices are available for floating roof tanks. The internal jointed pipe drain and the hose drain carry rain water to the outside of the tank and require a special shell connection in addition to the conventional water sump and draw-off connections. The jointed pipe drain usually requires a large oval manway in the shell for its installation and removal. If the joints leak, the product leaks out the open valve. If the valve is closed the pipe fills with oil or water which may freeze.

The hose drain has been improved in recent years by using synthetic rubber, non-kinking devices, and provisions for removal and replacement without completely emptying and purging the tank. All factors considered, it seems the preferable type if internal drainage into the product is objectionable.

Siphon, or straight-through drains may be used where rain water draining down through the tank contents is not objectionable. In the double deck roof, this is a simple drain with a seal to trap vapors and prevent evaporation. Product cannot back up onto the roof since the roof deck is above liquid level.

The siphon drain serves the same purpose on a single deck roof. It usually has a suspended container filled with water, and the difference in gravity between the water and oil prevents the product from backing up onto the roof,

which at this point is below the oil level. If the water in the siphon drain evaporates or is displaced, the product may back up onto the lower part of the roof.

These drains may freeze in winter and require salt or steam to keep them operative—another argument in favor of a hose drain. Sinclair believes that, in addition, all floating roofs should have vapor-sealed overflow emergency drains.

In the case of gaging devices, there is a wide choice ranging from the simple float to the electric remote reading type, and from $200 to $1000 or more, depending on the number of tanks involved in a system. Current trend in thinking among refiners is toward the more accurate, more dependable and more expensive instruments.

Regardless of the type of gage, there is still a need for the conventional hatch for making hand tape readings. Some plants are using a gage well pipe on floating roofs so that gaging can be done from the top platform to save time and improve safety. Sinclair is adopting this practice as standard.

As to cone roof fittings, it is probable that in some cases venting equipment is undersized for best operation and safety. Some of this equipment was installed when it was the practice to use reciprocating pumps for liquid transfer. Since that time, rates of filling and emptying have been increased. Sinclair plans to check on older installations and replace or supplement where venting is found deficient in capacity. Sizes are computed in accordance with the American Petroleum Institute venting codes with consideration being given to possible changes in service. This practice is cheap insurance against roof collapse or evaporation losses due to leaving roof hatches open.

The value of flame arrestors has recently been subject to some reappraisal. Some oil companies remove them in winter and others do not use them at all. Both the National Fire Protection Association and the National Board of Fire Underwriters have recognized this problem. The NBFU in their 1953 pamphlet No. 30 reflect this in the implication that it is not necessary to use flame arrestors if conservation vents are used. They also state that condensation and crystallization of certain materials and freezing in winter may make either of these devices impractical in very cold weather.

Since a flame arrestor element reduces the capacity of a vent valve by as much as 20%, its removal may greatly improve venting and make additional venting unnecessary. Sinclair intends in the future to use them only under special conditions where hazards are extraordinary, in services where they are not likely to become fouled with waxy or sticky deposits, and where they can be and will be inspected frequently.

Some new tank cleaning possibilities are offered in a fitting only recently included in the API standards, the flush-type cleanout. It is rather expensive—particularly in larger sizes—since it must be stress relieved with shell plate in which it is installed.

With four such fittings in the smaller sizes spaced around the tank, it is possible to remove a considerable amount of sludge through them by aiming hose streams through the shell manways before any personnel enter the tank. The clean-out cover may be equipped with pipe connection for pumping, or open sluices may take the sludge directly to pits in the diked area.

One company uses these fittings by placing a radial diverter plate in each opening to divert the swirling sludge. Another company has had some success in using a truck type hoist bin lowered into a concrete-lined pit adjacent the large flush opening. The sludge is scraped into the bin, then the bin is lifted out and hauled away.

This fitting is made in sizes from 8 by 16 in. to 4 by 4 ft. maximum. In addition to requiring stress relieving, there are several critical design features. It also requires provision in the concrete foundation for the extra thickness of bottom reinforcing plate and for removal of the flange bolts. It is urged that no home-made clean-outs of this sort be installed unless specifications are followed.

One detail needing improvement is the water draw-off connection. This gate valve connection is used frequently as a pump-out connection when the tank is cleaned, and it has customarily been packed in winter to prevent freezing.

Many refineries have eliminated this nuisance by installing an oil connection ahead of the draw-off valve to displace the water in the pipe when the valve is closed. Sinclair intends to make this a standard detail for all cold weather locations, using heavy seamless pipe and steel fittings and keeping the oil connection to the tank low enough to be effective when the contents are drawn down.

Sinclair's standards for tank fittings specify a minimum of two shell manways, with four on larger tanks. Also, an equal number of roof manways, usually equipped with aluminum hinged covers. On large tanks two internal sumps and water draw-off connections on opposite sides are specified.

These all provide great convenience in cleaning, it is felt. Their additional cost is quickly repaid by reduced labor and downtime and greater safety. It takes very few trips up a tank stairs with tools to unbolt flanged manways to pay for quick opening covers.

Inspection and maintenance is necessary to preserve the investment involved in the tanks and all their accessories. It is necessary also to prevent unnecessary losses of product and expensive repairs.

Since tank painting is a constant source of maintenance expense, Sinclair has been giving it some study in an attempt to reduce it. It has been found that costs are running from $1.00 to $2.53 per square (1100 sq. ft.) per year to paint a new tank and keep it painted over a reasonable life span. This variation in costs is due to different exposure conditions at the various plants and the kind of a job being done.

The general cost average is $1.51 per square, or about 1½ ¢ per sq. ft. per year for all the painted tank surfaces. A simple formula for determining annual unit cost and evaluating procedures is shown in the accompanying box on page 363.

Labor is the principal element of this expense, as might be expected, and material cost is secondary. Sinclair is therefore trying to reduce this labor cost and increase the durability of each paint job. Some tentative conclusions to a number of experimental programs, while not startling, are certainly significant. In summation, they are:

1—Provide for adequate surface preparation—including complete sandblasting and then immediate painting.

2—Keep to a minimum paint film thickness (dry) of 4 mils (0.004 in.).

3—Roller coating is preferable to brush application.

4—Repaint before the prime coats have been seriously damaged by weather.

When is the tank worn out? What is the proper retirement age for an oil storage tank? Internal corrosion is a major cause of tank obsolescence and its rate is difficult to predict. However, changing requirements, improved equipment, and the need to utilize ground space effectively are perhaps as important factors in obsolescence and more difficult to predict.

Tanks might be kept serviceable indefinitely by constantly renewing parts as they wear out, but such a procedure would be uneconomical. Eventually, it would result in a serviceable old tank, but outmoded in type, inefficient to operate, deficient in capacity or even too large, and

perhaps taking up space needed for other purposes.

There will come a time when the cost of repairs to make the tank serviceable, plus the reduction of wearing value, will equal the cost of a new tank. This certainly is the time to make a replacement.

If it is assumed that a 30-yr. period represents about the average life of a tank before it becomes obsolete because of type, size, or location; the time for retirement may be shown graphically as in the chart, Fig. 4.

Here, it is assumed that a new tank with accessories costs $50,000, and that it will be obsolete in 30 years and sold for scrap at say $3,000. The diagonal line is the obsolescence, or depreciation curve. Ordinates to it, less salvage value, represent its wearing value or its value as a utility at any given time.

The curve might be steeper due to rapidly changing requirements. However, a 30-yr. slope to scrap value seems a reasonable average and consistent with tank history.

The stepped curve represents an assumed cumulative maintenance and repair cost. The point where the two curves cross is not significant, since we are not concerned with money which has been spent but only with what will have to be spent in the future and what value can be gotten for it.

At some point it is likely that unusual repair expenses can be foreseen, such as shell ring replacements and perhaps a new bottom or roof. The cost of these repairs plus the reduction in wearing value up to this point may equal or exceed the cost of a new tank, and it is probably more economical to replace it.

This retirement point is subject to some control by staggering or bunching the repairs and deferring them for a year or two. It is also contingent upon service conditions, severity of corrosion, and extent of repairs necessary.

But, if for any definite short future period the anticipated aggregate maintenance and repair expenses will exceed the average wearing value for the same period, it is probably desirable to retire the tank and spend that money on a new one.

In many instances, floating roofs have been installed in old riveted shells where perhaps a more rigorous analysis would indicate that complete replacement was desirable. The old riveted shell is difficult to keep tight and painted. The rivets hinder operation to some extent, causing more maintenance on the roof seals and more evaporation losses than a smooth shell. Frequently the old tank has only an earth grade, and some settlement may have occurred, making straightening and plumbing necessary. A wind girder must be added and sometimes additional shell fittings. Many tanks of this age have a large diameter-to-height ratio, and the cost of the new roof—being a function of diameter rather than capacity—may be excessive.

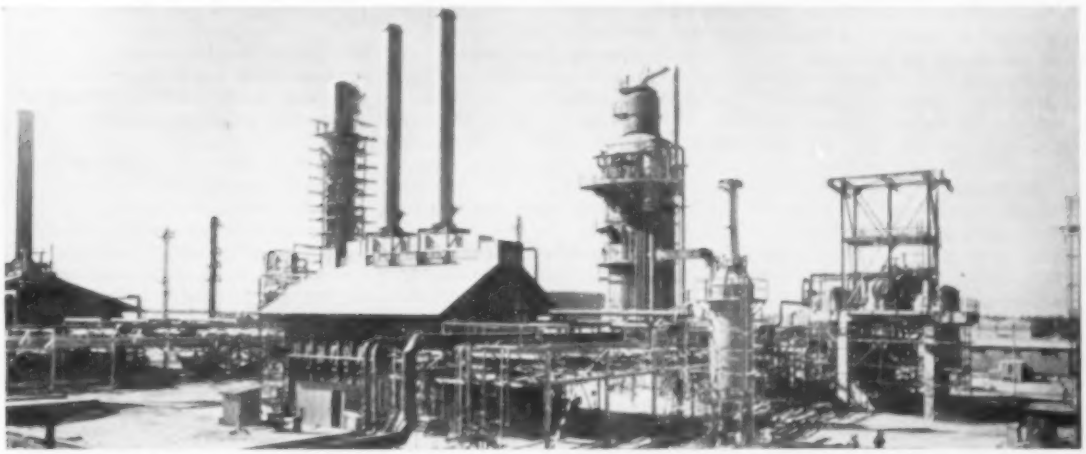
All these considerations plus the fact that the tank is probably not the most desirable size for the new service anyway will often make a complete replacement the more attractive investment.

Meet the Author

C. V. Lynn, project engineer in the central engineering department, Sinclair Refining Co., New York City, has been with the company since 1929 when he joined as a structural designer. He has been with the central engineering department during that same period, having served also as chief draftsman and as staff engineer.

A veteran of World War I with service in the United States Navy, Mr. Lynn received his B. S. in civil engineering in 1923 from the University of Illinois. He is a member of the American Petroleum Institute, and presently serving as chairman of the Storage Tank Committee.

NEWS in VIEWS



MORE REFINING FOR AUSTRALIA—this 24,000 b/d vacuum distillation unit is a part of a 70,000 b/d plant being built for Anglo-Iranian Oil Co. at Kwinana, near Fremantle, in Western Australia. Scheduled for completion early this year, the plant was designed and engineered by M. W. Kellogg Co. It is going a long way toward making the country self-sufficient in its petroleum needs, a goal which is expected to be reached by 1956.

PANEL OF PROCESSING TECHNOLOGISTS* who with the aid of a wire recorder will bring you . . .

Technical Tips on **Petroleum**

CAN you use technical hints and practical know-how as an aid to your every-day plant operations? Confident that the answer is an overwhelming "yes," the editors of PETROLEUM PROCESSING are pleased to present for the second consecutive year a series of questions and answers on virtually every type of processing problem.

As in 1954, this information has been obtained by means of a wire recording of dozens of questions and answers covered during a popular day-long session at a regional meeting of the Western Petroleum Refiners Association in El Dorado, Ark., last October.

Several hundred refiners stuck to their chairs throughout this session, hearing answers to prepared questions —and to more that popped up from the floor—being adroitly handled by a panel of ten technologists on the speakers' platform.

Wide experience, from five different refining companies and five suppliers of engineering services, was represented by this panel. The moderator was E. A. Heike, chief engineer, Premier Oil Refining Co., Ft. Worth, Texas, who repeated his role from the previous year.

The refining group included: J. M. Brown, assistant manager of operations, Pan-Am Southern Corp., El Dorado, Ark.; R. E. Feasel, supervisor of fuels manufacturing, Deep Rock Oil Corp., Cushing, Okla.; J. A. Gearhart, process engineer, American Liberty Oil Co., Mt. Pleasant, Texas; and R. S. Wilson, chief chemist, Lion Oil Co., El Dorado, Ark.

The engineering group consisted of: J. G. Eckhouse, sales engineer, Universal Oil Products Co., Des Plaines, Ill.; O. D. Edwards, sales engineer, Perco Division, Phillips Petroleum Co., Bartlesville, Okla.; D. E. Norris, commercial development engineer, Houdry Process Corp., Philadelphia, Pa.; F. D. Parker, western manager, Chemical Plants Division, Blaw-Knox Co., Tulsa, Okla.; and C. W. Rippee, president, Electric Process Co., Summit, N.J.

Problems discussed included many of the same kind that were covered in the 1953 WPRA sessions and published in PETROLEUM PROCESSING during 1954 (April, pp. 529-533; May, pp. 688-690; June, pp. 888-890; July, pp. 1059-1061). Subjects receiving attention were catalytic cracking, catalytic reforming, corrosion and erosion, coking, fractionation, alkylation, sweetening, and miscellaneous plant kinks.

This month's article comprises a number of questions and answers of a general nature. Future articles will cover the balance of the discussions. It is perhaps interesting to point out that your 1955 series will consist of an estimated 100 questions and over 200 answers. Last year's series had 77 questions and 115 answers.

Has anyone had experience with gaging coke drum bed levels or Fluid cat unit bed levels with a radioactive source and a Geiger counter?

From floor: We have had some success at Texas City with determining levels in standpipes with a Cobalt 60 source and a Geiger-Mueller tube. We haven't actually applied it to determining the level in the regenerator or the reactor. However, I am sure it would have application if you wanted to use it in that manner.

Gearhart: We haven't used it in any coke drums or Fluid beds, but we do use it continuously on the separator surge level in a Thermofor catalytic cracking unit. Our experience has been very successful there. In fact, while we were bringing the unit on stream we lost the hand gage—buried

* Left to right: Parker, Eckhouse, Norris, Rippee, Heike, Brown, Feasel, Gearhart, and Wilson. (Edwards was not present for the picture)

Processing Problems

it down in the catalyst—and haven't been able to use it since. We've relied entirely on the "Gagetron" (Geiger counter device). It has worked out very successfully.

From floor: **What diameter is that vessel?**

Gearhart: About 8 or 9 feet.

From floor: **Do you know the strength of your radioactive source?**

Gearhart: It's a very small amount. I could get that information for you. Incidentally, the spacing and the amount of radioactive material, I think, will vary with the type of material you desire to determine the level of, as well as the distance between the point of emission and the receiver, or counter tube.

From floor: **How about maintenance on the device?**

Gearhart: We have none so far: haven't touched it. When they work, don't touch them.

From floor: Our experts are about 500 miles from here. However, at one plant we have used an "Ohmart" instrument on determining formation of the coke bed in the drum. It's strictly in the experimental stage but it does tell you when the froth passes the device.

It distinguishes between just prior to the coke bed and the real coke bed. From the data we have, it's possible to determine coke drum outage. Our biggest problem has been to try and determine the factors, operationswise, to allow you to use the drum. We are trying to find out what causes carryover. We feel that maybe the extended use of this device will give us an answer to this kind of problem.

Heike: That's a capacitance unit, isn't it?

From floor: It uses Cobalt 60, I think.

Norris: We've had considerable experience with these in Houdriflow units. In fact, I think we in conjunction with Instruments, Inc., pretty much pioneered this type of use. Radiation sources in our units are actually inserted into the vessel. That would raise the question I might ask on the coke unit . . .

Your radiation source—is it internal or external?

From floor: Internal.

Norris: The absorption of the radiation—does that change with the presence of coke? You might find problems with that type of thing with the coke building up on your radiation source.

From floor: So far, there has been no particular problem along that line. It is mounted in a thermowell in the drum itself. The receiver is some distance opposite.

Norris: What we have are a series of sources more or less lined up vertically. Actually, they are staggered back and forth so that every source has a direct view of the counter. The radiation has a certain amount of metal to go through, and a certain distance to travel. The whole thing is worked out in a rather complex relationship with the largest radium source at the bottom, and the smallest one at the top.

There might be as much as 30 mg. of radium in a vessel. The vessel size doesn't have anything to do with limiting the amount or the effectiveness of it, because you are taking up a small segment of the wall. Any time the level falls, the radiation will pick up the difference. Once the initial adjustment is set, the thing appears to be very reliable. The only problem is that

you wonder what to believe when a tube goes out of order.(1)

What has been the experience in using plug cock valves instead of gate valves in vapor lines and black oil lines of coking units?

Parker: To our knowledge, there are two installations equipped with plug valves. One is at Sarnia and the other at McMurrey Refining, in Tyler, Texas. The latter unit has been running about five months now with excellent results. There are no problems at all with the plug valves.

Heike: What kind of valves are they?

Parker: Wilson-Snyder and Wedgeplug.

Brown: That's in the vapor line?

Parker: That's right. Wilson-Snyder for the coke drum transfer line switch valve, and Wedgeplug for the vapor line.

Brown: We have them on the transfer lines as switch valves, but didn't have them installed on vapor lines. The present vapor line gate valves leak very badly over a lengthy run. We were considering changing them to plug type valves.

What are the advantages of using steam in a thermal cracking coil? What are the dangers?

Parker: From the point of view of coking, where the steam is a very desirable element of design and operation; the advantages of using steam are, briefly, two.

First, the velocity through the furnace tubes can be increased without being dependent upon the vaporization of the oil—and when very heavy stocks are run you can't count on very much vaporization. So, the steam is automatically a means of keeping velocity up and minimizing coke formation in the tubes.

Secondly, and of considerable importance in coking or decarbonizing operations as we practice them, is that if the steam is there, whatever vaporization is accomplished can be done in the tubes rather than in the coke drum. That means that those vapors which are formed at relatively low oil partial pressures—because of the presence of steam—will remain as vapors because you supplied the latent heat of vaporization in the furnace tubes. You don't have to take that latent heat out of the furnace effluent in the coke drum, where the furnace effluent would automatically quench itself by a form of adiabatic operation.

This makes considerable difference in the amount of coke which will be made. That is, if most of the charge stock is vaporized in the furnace tubes and held vaporized, the non-vaporized portion is smaller. And since it is the part which goes to coke, the unit will produce a correspondingly lower quantity of coke and a correspondingly higher quantity of gas oil. This latter is the net product which you can convert to gasoline in the catalytic cracking unit.

Norris: It would be less severely cracked and probably a better catalytic charge stock for the same reason.

Parker: Yes. From the point of view of the catalytic operation; if when you go into the coke drum with the maximum potential gas oil vaporized, you don't have to depend upon additional cracking in the drum to make vapors to lift out the gas oil. This means that gas oil is closer to being virgin than it would be if it were condensed in the drum and then cracked enough to produce vapors to lift it out, producing a partially cracked gas oil.

From floor: This discussion covered the feature where you have some retention time after it leaves the coils. Suppose you don't do that? Suppose you quench at the coil outlet? If you introduce steam to increase velocity, you will reduce retention time, reduce severity, and reduce percentage conversion, etc.

Parker: I restricted my discussion to a coking operation for that reason.

From floor: Dale Fischbeck made a statement on that last year. He probably has had more experience on that than anybody else. I think he said that they had never found that water had any effect on cracking.

Heike: Didn't he also say that they inject water rather than steam?

From floor: Yes. Do it all the time, and it created velocity more than it affected cracking conditions.

Heike: He said that in so doing they were able to crack deeper and charge heavier residues, using that Selas-type heater with steam. Isn't that true?

From floor (George Brooner, Perco Div., Phillips Petroleum Co.): I don't recall all his remarks. The only recollection I have directly is using water in coils where we are putting heavy oil through a coil to vaporize it and coming out with 100% vapor. There, we used both water and steam in the coils to get over the dry point a little better without coking up.

Edwards: Back on that original question about steam in thermal cracking coils: I now have a reprint here of last year's minutes and I see Dale Fischbeck's comments.(2) The question last year was along the same lines: "Is anyone using water injection into thermal cracking coil feed to suppress coking? What are the results?" The answer was:

"Yes, water has been used in some thermal cracking coils. It permits deeper conversion. If the cracking coil is oversized and operated at low velocities, water injection may be helpful. Otherwise, if the coil is properly sized, water injection may not be very advantageous. Higher cracking temperatures are possible when using water injection.

"For years, water in the form of steam has been admitted to the radiant section of our (Phillips) Cycloversion heater. Some coking was normally experienced in the heating coil, a few tubes downstream from the steam injection point.

"By putting steam or water in with the feed stock, less coking problems are experienced because the coke is laid down more uniformly. Water injection has been used for many years in vis-breaking and other thermal cracking coils. I would consider the practice more common than uncommon.

"Someone will ask, I am sure, 'How much water do you use?' That depends upon the coil size and the other factors. We have used as low as 1 wt.-% of water, based on the weight of the charge stock, and as high as 10 wt.-% on heavy hydrocarbon. On light hydrocarbon, it is not uncommon to use 1:1 mol ratios of water to hydrocarbons. We try to adjust the water injection to the design of the coil and the heater for the cracking job to be done."

Has anyone experienced plugging of

(1) See also:
"Using Radioactivity in the Refinery," PETROLEUM PROCESSING, April, 1953, pp. 551-553.
"Hot Atoms Measure Liquid Level," PETROLEUM PROCESSING, Sept., 1952, pp. 1286-1288.
"Atomic Energy Applied to Measurement of Catalyst Levels in Cracking Units," PETROLEUM PROCESSING, Sept., 1950, pp. 941-945.

(2) "Technical Tips on Thermal Cracking and Reforming," PETROLEUM PROCESSING, June, 1954, pp. 888-890.

the isobutane recycle lines in HF alkylation units?

Edwards: We have not experienced any plugging in the isobutane or acid recycle lines, nor have we experienced any gumming in fractionator reboilers, including those on alkylate splitting columns. I think the question may concern silica migration and plugging by it of overhead condensers. We have not had that problem for the last ten years, at least. I think it did come up in the first year of our HF operations. It was avoided simply by soda ash circulation through the overhead condensers.

What effect does reactor space velocity have on alkylate quality, yield, and octane numbers in sulfuric acid alkylation?

How does reactor temperature affect acid consumption in sulfuric acid alkylation? Over what temperature range is acid consumption unaffected? What effect does reactor temperature have on alkylate quality and octane numbers?

Parker: Briefly, I am sure those who are operating units have the data on effect of throughput. Increases in throughput do not necessarily cut the space velocity proportionately, since they usually involve reduction of isobutane recycle to suit the total load capacity of the fractionation system.

Generally speaking, if you were to double the reactor throughput, on an ASTM octane basis you might be talking something like two points or so reduction. That, of course, will vary depending upon the charge stock and the normal design situation for temperature and isobutane recycle. If you double throughput, you get a few points reduction.

Similarly on temperature, I think it is fairly well known that in the range of 30 to 50°, there isn't much difference in the acid requirement. As far as its effects on quality, anything that is going to reduce the amount of acid usually increases the quality of the alkylate.

Conversely, if you are using a lot of acid, you are probably getting a lower quality alkylate from the unit. Normally, you should get, for a butene charge stock, something like a 0.5 lb. per gal. utilization. If you are using twice that much, it's either due to temperature (which you would know), or you have something else in the feed stock, such as butadiene, which will have much more important effect on acid consumption than temperature alone.

From floor: **Mr. Parker has brought in a "stranger" there. I'd like to ask him what his experience has been with ethylene in his feedstock?**

Parker: That's also bad.

From floor: **Just how bad is what I wanted to know. About a 61 octane C-3?**

Parker: It's pretty hard to come out with a precise figure because you are talking about a charge stock analysis which, at best, is somewhat inaccurate when you don't have much ethylene there, and it is usually in a mixture.

Ethylene alone will take very large quantities of acid. But when it is mixed with butene—in other words, performing the alkylation reaction in parallel—you get a dampening effect; so the ethylene isn't so bad.

Say you are talking in the range of 5 or 10 times the acid consumption for ethylene that you would have for propylene. That wouldn't hold for a wide range of concentrations. That would be just the first trace of ethylene in the feed stock. If the ethylene concentration went up, the acid requirements would go up disproportionately.

Rippee: This point does not apply exactly to alkylation. One time the du Pont Company investigated some major oil companies for selling spent acid for pickling steel. The most important thing was the carbon content of the sulfuric acid.

Some operators of sulfuric acid alkylation plants would be surprised to know that they could find as much as 10 or 15% of carbon in the spent acid. It is this solid carbon that eventually stops the alkylation reaction. After some of these sludges have been heated you can use a shovel to move them around because they go so solid. It is the carbon content in the sulfuric acid that is so very important. The carbon content is determined by oxidizing the carbon compounds in the acid with chromic acid.

From floor: **How would you control the carbon level in spent acids? By strength of the acid? Would you reject at some strength level?**

Rippee: The HF alkylation operators know that it is necessary to dehydrate the stock by a very inexpensive method. There are some 35 sulfuric acid alkylation plants in operation but, to the best of my information, not one of these plants dehydrate their feedstock. Since 98% sulfuric acid contains 5% of SO_3, one mol of SO_3 in 1600 lbs. of acid reacts with one mol of water in the feed stocks.

A year ago, the Beckman firm brought out the "Aquameter" for the determination of moisture by the Karl Fischer method. The cheapest way is to dehydrate the stock—keep that water out—because that water is going to use up the SO_3. The biggest saving in the sulfuric acid alkylation plant is to dry the feedstock.

What have been the advantages experienced with the replacement of bubble cap trays by any of the new types of fractionator trays?

Heike: There is a company set up to do this evaluation now.

Parker: I believe Fractionation Research, Inc., is conducting a program along that line.(3) As contractors, our own company is occasionally called upon to make a number of comparative studies of bubble cap versus "Turbogrid," or other proprietary types of trays.(4) We have in some of our work made replacements of bubble caps with other proprietary models, including Turbogrids, Kaskades, and, in some cases, just plain, simple, perforated plates.

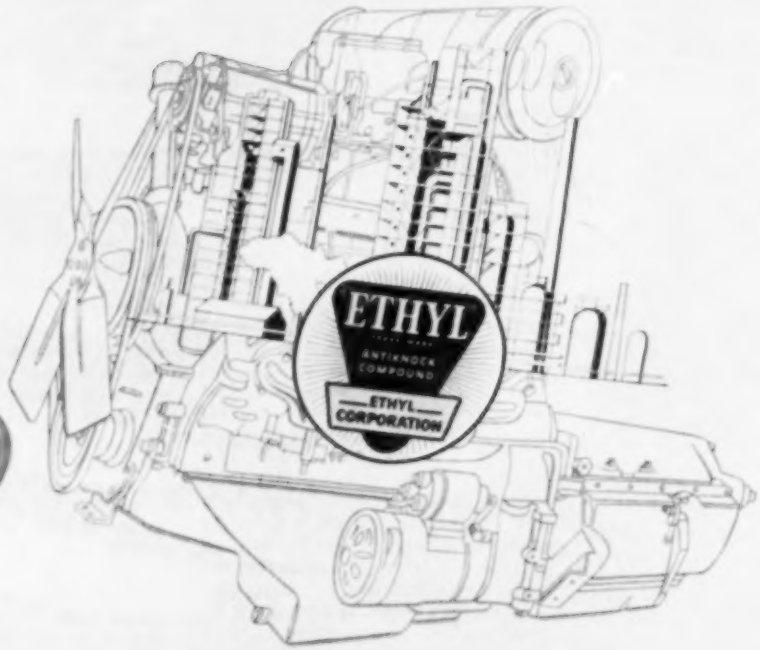
In general, our experience has been satisfactory. In other words, where we have made a replacement, we have not introduced any problems which weren't there before. In the few cases where you can really look at the installation to see if it is performing better or worse, we can say qualitatively it is performing better, but quantitatively we can't honestly say it's not doing anything that a well-designed bubble cap tray wouldn't have done in the first place.

From floor: I might say that one advantage of these newer type trays is probably the low pressure drop through the tray. And that becomes particularly valuable in the design of vacuum units. It's impossible to get down to the vacuum at the flash zone with bubble cap trays that you might get with, say, shower decks or some other types of tray. There apparently is a big advantage in that one particular field.

(3) See also: "Non-Profit Fractionation Research," PETROLEUM PROCESSING, Sept., 1954, pp. 1370-1375.

(4) See also:
"Spiral Flow for Better Distillation," PETROLEUM PROCESSING, April, 1953, pp. 556-559.
"New Venturi Fractionator Tray," PETROLEUM PROCESSING, May, 1952, pp. 623-627.
"New Bubble Tray Design," PETROLEUM PROCESSING, Oct., 1952, p. 1447.

ROAD BEHAVIOR
OF
COMMERCIAL PREMIUM FUELS
1954



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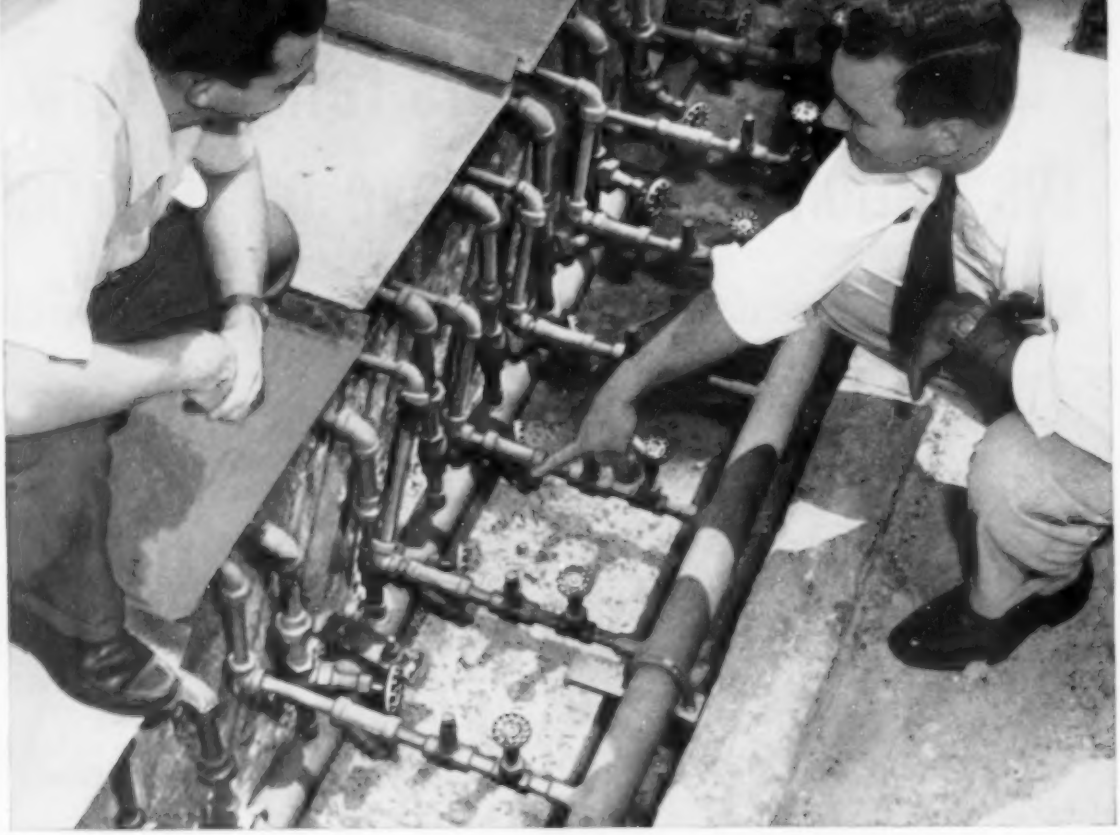

CRANE VALVES have longest life in this sulphur pit

THE CASE HISTORY— Leakage in steam lines to sulphur pit heating coils was hindering operations at International Minerals & Chemical Corp. plant at Lockland, Ohio. The condition prevented servicing of traps, strainers and the heating coils.

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Corrosioneering News

Petroleum Processing

MARCH 1955

Petrochemical Section

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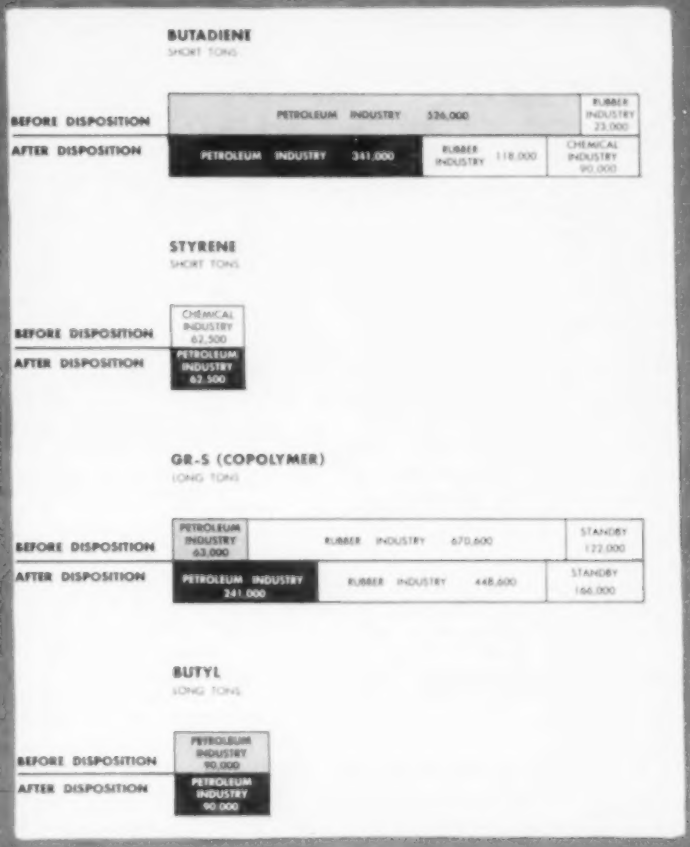
Who Was Left Out?
Unsuccessful bidders might still be thinking of expansion in butadiene and styrene —p. 380



In the Departments

Scaffold provides safe working platform for speeding up maintenance on tank cars, plus other "how-to-do-it" kinks—(Plant Practices) p. 383

Catalyst treatment will stabilize mineral oils against gum formation in storage, a newly patented idea—(Patents) p. 387

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Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.

Published by The Pfaudler Co., Rochester, N.Y.

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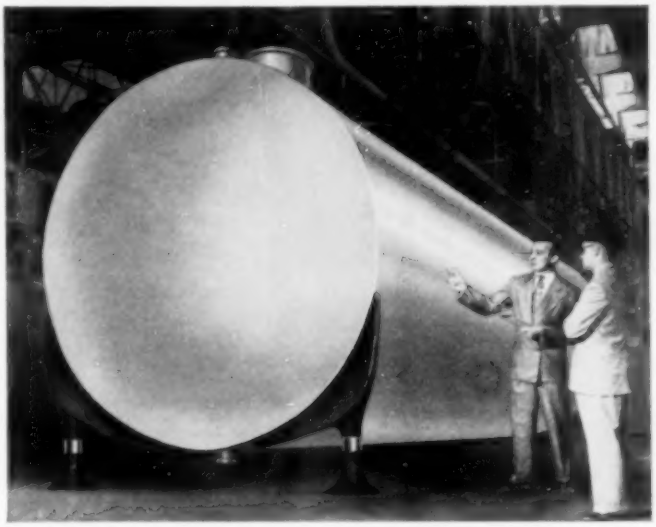
One of our process engineers, W. F. Swanton, has written an evaluation of various types of columns, called "How to Buy a Column." Write for your free copy of this helpful guide.



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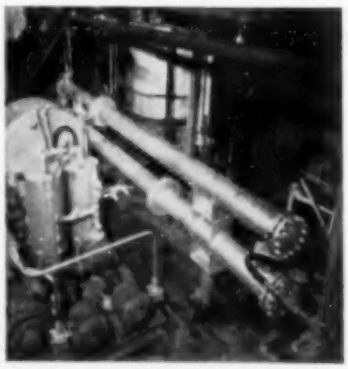
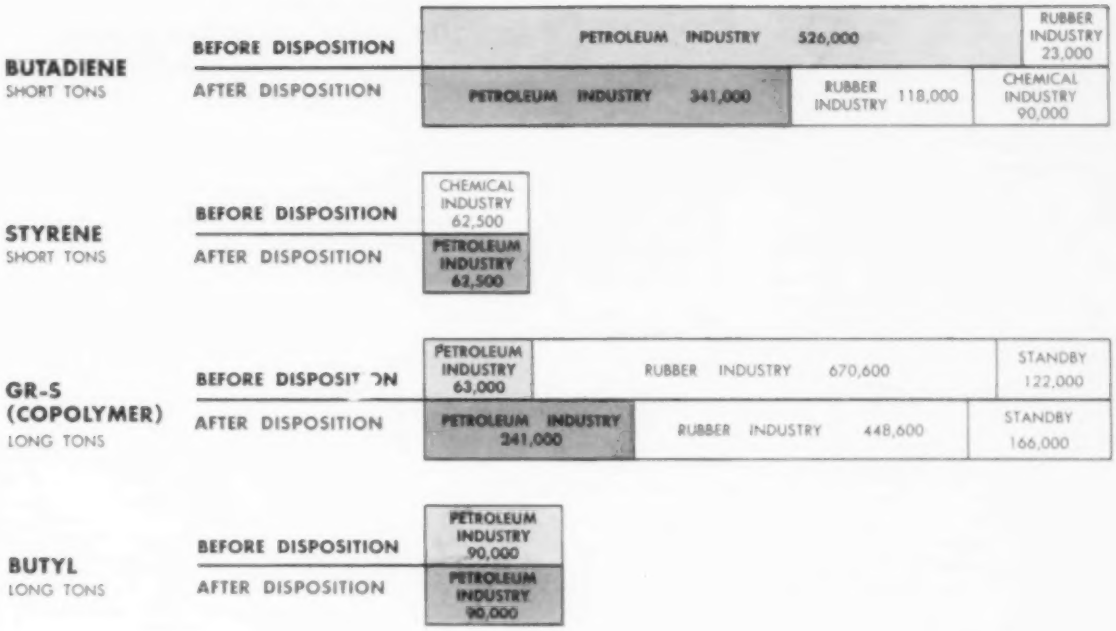


MONEY-SAVING TIP: Emphasize length rather than diameter, when buying heat exchanger, as shown in this installation.

(To obtain more data on advertised products see page 404)



The Pattern Changes for

Petroleum's Role in Synthetic Rubber

THE petroleum industry is about to change its whole pattern of participation in the synthetic rubber industry. If the program worked out for selling the government's synthetic rubber facilities to private firms gets past Congress, it will:

- Break petroleum's near-monopoly on the butadiene end of the rubber industry. Where oil companies operated over 95% of the petroleum-butadiene capacity in the past, they will now own only about 62%.
- Put an oil company in the styrene business for the first time. The single government-owned styrene plant, previously operated by Dow Chemical, goes to Shell.
- Put petroleum companies in command of about a third of the GR-S copolymer capacity in the country—with four oil firms or their subsidiaries signed up to purchase such plants—Shell, Phillips, Gulf, Texas. Only Phillips was in that end of the business before.
- Leave oil companies in control of the two butyl rubber plants. Both of them will remain in the hands of their present operators—Esso Standard and Humble.

What it boils down to: Stiffer competition at both ends of the business—raw materials, finished products. There will be some butadiene plants no longer tied to previous supplies of refinery gases. Likewise, there will be some copolymer plants no longer tied to fixed supplies of butadiene. At the product end, all of the copolymer plants to be owned by oil companies—some 241,000 long tons of annual capacity—will be selling on the open market, not to captive outlets.

There appears little chance, however, that the oil industry is going to get into the rubber fabricating business. Phillips Chemical, the only petroleum industry firm to have operated a GR-S copolymer plant under government ownership and therefore the one you might believe most likely to move in that direction, states positively that it is not considering the manufacture of rubber goods.

There's another result: Those oil companies with butadiene know-how and experience because of previous connections with the government-owned plants but who are now out of the picture may be looking for places to apply their talents. There are three:

Sinclair Refining Co.—which has been operating the second largest butadiene plant, the one at Houston, through its subsidiary Sinclair Rubber Co. Sinclair bid on that facility, but not enough.

Pure Oil and Atlantic Refining—both of whom have had a minority interest in the Neches Butane Products Co., operator of the butadiene plant at Pt. Neches, the biggest in the country. Neither one bid on any of the plants.

The sale "package" for disposal of the government-owned synthetic rubber plants was worked out by the 3-man disposal commission set up by Congress in 1953, and covers 24 of the 27 major facilities. The package was presented to Congress in January, following more than a year of negotiations between the Commission and prospective purchasers.

Of the 24 plants covered by the disposal program, 13 are scheduled to be sold to oil companies or firms in which oil companies have an interest. Nine oil companies are concerned:

- **Shell Oil,** wholly-owned chemical subsidiary, will own the only completely integrated complex for making butadiene, styrene and their combined product, GR-S rubber. Its plants in the Los Angeles metropolitan area will produce more rubber than now consumed on the west coast.
- **Phillips Petroleum,** also through its chemical subsidiary, will own the butadiene and GR-S plants at Borger, Texas, that it has operated for the government.
- **Gulf Oil and The Texas Co.** will each be half owners (with Goodrich and U.S. Rubber, respectively) of large GR-S manufacturing units at Port Neches, Texas.

In addition, the Goodrich-Gulf and Texas-U.S. combines will jointly operate the giant butadiene plant at Neches.

- **Cities Service and Continental Oil's** joint subsidiary, Petroleum Chemicals, Inc., not only will operate the butadiene plant at Lake Charles, La., but is already planning to expand it. Also being considered: production of butyl rubber.
- **Two Jersey Standard companies,** Humble Oil & Refining and Esso Standard Oil, will own the two butyl rubber plants at Baytown, Texas, and Baton Rouge, La. Humble will also own the butadiene works at Baytown.
- **Standard Oil of California** will take over the crude butadiene production unit it now operates at El Segundo, Calif. This plant's output goes to the neighboring Shell Chemical unit for final purification.

The sale of these plants—and the others that make up the government's synthetic rubber monopoly—is without precedent in U.S. history. No other plants the government has operated have been so closely tied to one another; no other disposal has been limited in as many ways by Congress; and no other sizable disposal has given the government back so high a return on its investment.

The Disposal Commission's package will bring in $260 million for the 24 plants it sold, plus $26 million for work-in-progress, spare parts, raw materials. In addition, bidders will be able to buy some $25 million worth of rubber inventories now held by the government. When you add to this the estimated $91 million cash balance of the Federal Facilities Corp., which now operates the plants, total return to the government will be $401 million.

The return is amazingly high—when you figure that the plants are some 12 years old. The Disposal Commission estimates on the basis of a 1952 survey by the Ralph M. Parsons Co. that the $260 million contract prices represent 99.2% of plant replacement value. Too, this return brings in 96.6% of the government's total unrecovered investment in synthetic rubber. The government will still own plants and equipment worth some $19 million following the disposal.

Under terms of the disposal act, passed in 1953, Congress has 60 days to look over any sale package that the Disposal Commission could come up with. Either the Senate or the House of Representatives may vote its disapproval of the whole disposal or any individual sale.

If single contracts are voided, any other prospective purchaser may withdraw. The whole program would be voided if less than 500,000 lt GR-S or 43,000 lt butyl capacity is to be finally sold.

This 60 day period began Jan. 27, and as PETROLEUM PROCESSING went to press, no substantial opposition had developed.

Price leadership for the synthetic rubber industry, according to classical economics, would come from Port

The Lineup . . . Before Disposal

Facility and Location	Operated By	Capacity* Pet. Ind.	Operated By Others
BUTADIENE:			
Lake Charles, La.	Cities Service Refining Corp.	63,000	
Baton Rouge, La.	Copolymer Corp.		23,000
Pt. Neches, Texas	Neches Butane Products Co.	190,000	
Baytown, Texas	Humble Oil & Refining Co.	46,000	
Houston, Texas	Sinclair Rubber, Inc.	90,000	
Borger, Texas	Phillips Chemical Co.	74,000	
Los Angeles, Calif.	Shell Chemical Corp.	63,000**	
Los Angeles, Calif.	Standard Oil Co. of Calif.		
Total		526,000	23,000
% of Total		95.8	4.2
STYRENE:			
Los Angeles, Calif.	Dow Chemical Co.		62,500
Total		0	62,500
% of Total		0	100
GR-S COPOLYMER:			
Lake Charles, La.	Firestone Tire & Rubber Co.		99,600
Baton Rouge, La.	Copolymer Corp.		49,000
Pt. Neches, Texas	B. F. Goodrich Chemical Co.		90,000
Pt. Neches, Texas	United States Rubber Co.		88,000
Baytown, Texas	General Tire & Rubber Co.		44,000
Houston, Texas	Goodyear Synthetic Rubber Corp.		99,600
Borger, Texas	Phillips Chemical Co.	63,000	
Los Angeles, Calif.	Midland Rubber Corp.		89,000
Akron, Ohio	Firestone Tire & Rubber Co.		30,000
Akron, Ohio	Goodyear Synthetic Rubber Corp.		15,200
Institute, W. Va.	(In stand-by, 122,000 tons)		
Louisville, Ky.	Kentucky Synthetic Rubber Corp.		44,000
Naugatuck, Conn.	United States Rubber Co.		22,200
Total		63,000	670,600
% of Total		8.6	91.4
BUTYL RUBBER:			
Baton Rouge, La.	Esso Standard Oil Co.	47,000	
Baytown, Texas	Humble Oil & Refining Co.	43,000	
Total		90,000	0
% of Total		100	0

* Capacity figures are given in terms of short tons for butadiene and styrene, in long tons for the rubber products.

** These two plants operate in tandem.

. . . . . and After Disposal

Facility and Location	To Be Purchased By	Capacity* to be Owned by Pet. Ind.	Capacity* to be Owned by Others
BUTADIENE:			
Lakes Charles, La.	Petroleum Chemicals, Inc.	63,000	
Baton Rouge, La.	Copolymer Corp.		23,000
Pt. Neches, Texas	Goodrich-Gulf-Texas-U.S.	95,000	95,000
Baytown, Texas	Humble Oil & Refining Co.	46,000	
Houston, Texas	Food Machinery and Chemical Corp.		90,000
Borger, Texas	Phillips Chemical Co.	74,000	
Los Angeles, Calif.	Shell Chemical Corp.	63,000**	
Los Angeles, Calif.	Standard Oil Co. of Calif.		
Total		341,000	208,000
% of Total		62.1	37.9
STYRENE:			
Los Angeles, Calif.	Shell Chemical Corp.	62,500	
Total		62,500	0
% of Total		100	0
GR-S COPOLYMER:			
Lake Charles, La.	Firestone Tire & Rubber Co.		99,600
Baton Rouge, La.	Copolymer Corp.		49,000
Pt. Neches, Texas	Goodrich-Gulf Chemicals, Inc.	45,000	45,000
Pt. Neches, Texas	Texas Co.-U.S. Pubber Co.	44,000	44,000
Baytown, Texas	(Not sold, 44,000 tons)		
Houston, Texas	Goodyear Synthetic Rubber Corp.		99,600
Borger, Texas	Phillips Chemical Co.	63,000	
Los Angeles, Calif.	Shell Chemical Corp.	89,000	
Akron, Ohio	Firestone Tire & Rubber Co.		30,000
Akron, Ohio	Goodyear Synthetic Rubber Corp.		15,200
Institute, W. Va.	(Not sold, 122,000 tons)		
Louisville, Ky.	American Synthetic Rubber Corp.		44,000
Naugatuck, Conn.	United States Rubber Co.		22,200
Total		241,000	448,600
% of Total		34.9	65.1
BUTYL RUBBER:			
Baton Rouge, La.	Esso Standard Oil Co.	47,000	
Baytown, Texas	Humble Oil & Refining Co.	43,000	
Total		90,000	0
% of Total		100	0

Notes: Alcohol-butadiene plants excluded from this tabulation on the basis that they are not significant in the commercial butadiene picture
Copolymer plants in stand-by or unsold are not included in totals.

Neches, since the plants there represent 25.9% of total GR-S capacity. Because of Justice's interest, however, prices will probably be set by the independents — Shell and Phillips — who represent 12.9% and 9.1% of total capacity, respectively.

Phillips has been signing firm one-year contracts at a 25¢ delivered price —up 0.9¢ from the comparable government figure. Shell has offered to sell the inventories it will buy from the government at the 24.1 price. And while the price for rubber probably won't firm up in less than two years, it looks like it will be below the 26-27¢ figure that was predicted back in 1953. Stabilization at a lower figure will undoubtedly be the result of the raw material—end product integration that Shell and Phillips have.

All in all, few observers feel that the proposed disposal will make for less competition in the rubber or rubber raw material field. Most of the objections on anti-trust grounds expected out of Congress will, they feel, come from persons who do not take into account the fact that a large capital investment is needed to effectively compete in the field. And that, certainly, the proposed disposal extends, not contracts, competition.

Some other oil company may yet get into the rubber business. The only one of the three government rubber plants left unsold* that is considered salable is the GR-S facility at Baytown.

And since it became known that General did not come to agreement over the plant, the congressman from the district, Albert Thomas, has submitted a bill that would allow further negotiations to reach full, fair value on it. A similar bill has been introduced by the two Texas senators, Lyndon Johnson and Price Daniel. Their announced reason: since the plant is economic, there is no reason that it should be put into standby, thus needlessly throwing employes out of work.

Some observers feel that passage of such a bill essentially negates the spirit of present disposal legislation. If it does go through, however, there is some speculation over who would bid for it. It's assumed that General does not want it at a higher price than already offered, since the company has been moving away from full-line competition with the rubber big four.

Among those rumored to be interested are the Hugh Roy Cullen interests, and the big four rubber makers. These companies—according to this line of thinking—would jointly operate the plant, which can make oil black rubber masterbatches, a type otherwise produced only by Phillips. Those who tend toward this thesis point to the fact that, unlike the current disposal law, the bills which would allow further Baytown negotiation do not require sale approval by the Attorney General. A third possible contender is Sinclair, which has operated the butadiene plant at Houston. The new operator, Food Machinery and Chemical, has contracted for butanes from Tennessee Gas Transmission, leaving Sinclair's butylene output unused.

But since Sinclair would then have to put in its own butadiene units, its purchase of the Baytown GR-S facility is not considered likely.

For the future outlook for the synthetic rubber industry is bullish. The Paley Report envisions 1975 world consumption of rubber to total some 5 million long tons—better than double the current amount. It's estimated that half of this will have to be supplied by synthetic—almost a trebling of the current capacity.

There is an additional long-term growth potential for both GR-S raw materials: butadiene for a nylon intermediate, and for use in making plastics, and styrene in plastics. A group, including Warren Petroleum and The Fluor Corp. have drawn tentative plans for a 100,000 ton butadiene plant in West Texas. This plant would compete for both rubber and non-rubber uses.

* The other two: The 122,000 ton/yr. GR-S plant at Institute, W. Va., maintained in stand-by by B. F. Goodrich Chemical Co., and the 87,000 ton/yr. butadiene-from-alcohol at Institute, maintained in stand-by by Carbide & Carbon Chemicals Co.

SYNTHETIC RUBBER PRODUCING PLANTS, by type and by location

What's in the Wind?

Butadiene and Styrene Plans

THOSE companies which were successful in bidding on the synthetic rubber facilities are reluctant at this stage of the game to say anything about their plans. They want to wait until the disposal program is safely through Congress, rather than running the risk of having any statements quoted out of context and possibly misunderstood.

Careful study of the Rubber Producing Facilities Disposal Commission's Report to Congress, however, reveals some of the ways in which the facilities will be operated and what expansion might be in the wind.

Here's a brief summary of some of the more positive programs for operation of the butadiene and styrene plants, as outlined in the various proposals made:

Copolymer Corp., a joint venture of six independent rubber firms and Sears Roebuck & Co., was the only non-petroleum company operating a butadiene plant for the government. The company bid successfully for the plant at Baton Rouge, which it has been operating since it was reactivated in 1950. This plant has no feed preparation unit, however, so that it is restricted to buying purified butylene as its raw material. Esso Standard Oil Co. has supplied these requirements in the past—and will probably continue to do so.

All of the product butadiene will probably be used in the adjacent copolymer plant, on which Copolymer Corp. was also the top bidder. Since the rubber plant requires 40,000 tons of butadiene annually for capacity operation against the butadiene plant's top output of 23,000 tons, it is likely that the latter may be expanded.

Copolymer has studied the possibilities of installing a feed preparation unit to permit it to use butane feed stock, as well as the cost of a Houdry dehydrogenation unit. The latter was estimated at between $10-15 million to furnish enough butylene and butadiene to run the rubber plant at capacity.

Food Machinery & Chemical Corp. was top bidder for the 90,000-ton butadiene plant at Houston which Sinclair Rubber has been operating. Feed stock in the past has been refinery butylenes, secured primarily by pipeline from the plants of Sinclair Refining at Houston and of Pan American Refining and Republic Oil at Texas City.

Food Machinery contemplates switching over to butane, and to secure a source of that material may form a new 50-50 venture with Tennessee Gas Transmission Co. Most of the butadiene product will be sold to the Copolymer plant at Houston. Product not so sold, apart from Food Machinery's own needs (estimated at 10,000 short tons or less annually, but not otherwise defined) will be offered on the open market.

Goodrich, Gulf Oil, Texaco and U.S. Rubber teamed up to jointly purchase the giant 190,000 ton butadiene plant at Port Neches, now being operated by the Neches Butane Products Co. The first two firms have formed Goodrich-Gulf Chemicals, which will own a one-half interest in the undivided butadiene plant. The Texas Co. and U.S. Rubber propose to form a similar corporation (probably to be known as Texas-U.S. Chemical Co.) to own the other half interest.

The plant will be operated as a single processing facility and it is intended that the operating company shall function as a service company for each of the owners in much the same fashion that the present operator of the facilities, Neches Butane Products Co., functions on behalf of the government.

As a means of implementing this agreement, the companies intend to acquire Neches Butane Products Co. as the entity to operate the plant and in this way preserve the continuity of management and uninterrupted operation. Goodrich-Gulf and Texas-U.S. will separately acquire and independently furnish feed stocks to the processing company for conversion into butadiene. The resultant butadiene will be delivered by the processing company to Goodrich-Gulf and Texas-U.S. in quantities equivalent to the yield from the feed stock furnished by each of them.

The nearby refineries of Gulf and Texaco are the principal feed stock suppliers at present, and have been the main sources of feed stocks since the plant first went into operation. They probably will continue in that capacity, with assists from Atlantic Refining and Pure Oil.

Each of the two teams—Goodrich-Gulf and Texas-U.S.—is independently acquiring one of the two copolymer plants at Port Neches, and will therefore have a captive outlet for a large portion of the butadiene product. Goodrich-Gulf estimates, however, that it will have about 17,000 tons of butadiene annually available for sale on the open market, and Texas-U.S. will similarly have about 26,000 tons.

Humble Oil and Refining Co. was top bidder on the butadiene plant at Baytown, as well as on the butyl rubber plant there. The two facilities are interrelated to the extent that

the butyl plant prepares feed stock for the butadiene plant by removing iso-butylene from it. All feed stocks will probably be available from Humble's own refinery operation at Baytown. About 80% of the butadiene made in the Baytown plant will be sold through Enjay Co., an affiliate of Humble, and arrangements are being made to dispose of it to American Synthetic Rubber Corp. and Copolymer Corp. The balance will be offered for sale on the open market.

Petroleum Chemicals is a joint venture of Cities Service Co. and Continental Oil Co., and the butadiene plant at Lake Charles will be its first petrochemical manufacturing venture. Butadiene product of the plant has at all times in the past been supplied to the adjacent copolymer plant, and will probably continue to be available to that outlet. In order to supply sufficient butadiene to keep the copolymer plant operating at capacity, however, the annual capacity of the butadiene plant would have to be increased from its present 60,000 short tons to 78,200 short tons.

Engineering studies by Petroleum Chemicals indicate that such an increase in capacity would cost about $4,500,000. Even though the copolymer plant may not require this much butadiene, Petroleum Chemicals has indicated that it may still increase the butadiene plant capacity. Cities Service has agreed to supply up to 2,000 b/d of butylene feed stock from its adjacent refinery, and additional butylenes for any increase in capacity are available from the nearby refinery of Continental.

At one point, Petroleum Chemicals had planned to bid on both the butadiene and copolymer plants at Lake Charles. After some further study, however, the company concluded that it had best steer clear of what it termed the "unfamiliar and hazardous marketing problems" that acquisition of the copolymer plant would entail.

Phillips Chemical Co. has bid on the butadiene and copolymer facilities at Borger—both of which it is presently operating for the government. Butadiene plant uses high purity normal butane as feed stock, and Phillips Chemical has arranged for this material to be supplied (as in the past) by its parent—Phillips Petroleum Co. —to the extent of 4,200 b/d.

Although the major portion of the butadiene product will be used by the adjacent copolymer plant, Phillips expects to have from 25,000 to 35,000 short tons per year of butadiene available for sale to others. Phillips doesn't anticipate a market for all of this capacity for some years, however, and as a consequence expects to produce butylene for sale on the outside so that it can operate the feed preparation units at capacity.

Shell Chemical Co. will operate the only completely integrated butadiene-styrene-copolymer facilities in the country. The company bid on these three plants in the Los Angeles area with the clear understanding it wanted all or none. "We do not state any order of preference for the purchase of the foregoing facilities," Shell advised the Disposal Commission, "for the reason that we do not propose to purchase individual facilities."

About 55%, or 900 b/d, of the butadiene plant's butylene feed stock needs will be supplied by Shell Oil Co., and the balance purchased from other refiners in the area. About 37% or 750 b/d of the styrene plant's propane feed stock likewise will be supplied by Shell Oil, and the balance secured from other sources.

First choice for the benzene requirements of the styrene plant will be existing sources of crude benzene from coking operations, with about 9,000,000 gal./yr., or 60% of the plant's needs, being filled by that source. The remainder can be obtained from benzene producing facilities at Shell Oil's Dominguez refinery, or from Shell Oil's Houston refinery. Shell expects that the bulk of its butadiene production will be used by the copolymer unit, but that an excess of styrene will be available. The company intends, therefore, to move substantial amounts of styrene to the Gulf Coast area for disposal there.

Standard Oil Co. of Calif. was sole bidder on the butadiene plant at Los Angeles (El Segundo) which it has been operating in tandem with the other Los Angeles butadiene plant (at Torrance)—supplying a butadiene-butylene mixture to Torrance for purification and further processing. There's some indication the company might plan to install additional manufacturing and recovery facilities in the El Segundo plant to permit it to operate as an independent unit.

Successful Bidders for Synthetic Rubber Facilities

Location and Plancor Co.	Buyer	Assigned Capacity[1]	Price
Petroleum Butadiene:			
Baton Rouge, La. (152)	Copolymer Corp.	23,000	5,000,000
Lake Charles, La. (706)	Petroleum Chemicals, Inc.	63,000	16,000,000
Pt. Neches, Texas (933)	Goodrich-Gulf—Texas-U.S.	190,000	53,000,000
Baytown, Texas (485)	Humble Oil & Refining Co.	46,000	8,886,000
Houston, Texas (1063)	Food Machinery & Chemical Corp.	90,000	24,197,000
Borger, Texas (484)	Phillips Chemical Co.	74,000	19,100,000
Torrance, Calif. (963)	Shell Chemical Corp.	48,000	[2]
El Segundo, Calif. (1593)	Standard Oil Co. of Calif.	50,000[3]	1,500,000
Styrene:			
Torrance, Calif. (929)	Shell Chemical Corp.	62,500	[2]
GR-S Copolymer:			
Baton Rouge, La. (876)	Copolymer Corp.	49,000	5,000,000
Lake Charles, La. (1056)	Firestone Tire & Rubber Co.	99,600	11,650,000
Pt. Neches, Texas (983)	Goodrich-Gulf Chemicals, Inc.	90,000	13,000,000
Pt. Neches, Texas (983A)	Texas-U.S.	88,000	11,500,000
Houston, Texas (956)	Goodyear Synthetic Rubber Corp.	99,600	11,889,000
Borger, Texas (982)	Phillips Chemical Co.	63,000	4,525,000
Torrance, Calif. (611)	Shell Chemical Corp.	89,000	[2]
Naugatuck, Conn. (129)	U.S. Rubber Co.	22,200	3,200,000
Akron, Ohio (127)	Firestone Tire & Rubber Co.	30,000	2,250,000
Akron, Ohio (126)	Goodyear Synthetic Rubber Corp.	15,200	2,075,000
Louisville, Ky. (1278)	American Synthetic Rubber Corp.	44,000	2,340,000
Butyl Rubber:			
Baton Rouge, La. (572)	Esso Standard Oil Co.	47,000	14,857,000
Baytown, Texas (1082)	Humble Oil & Refining Co.	43,000	17,500,000
Alcohol Butadiene:			
Kobuta, Pa. (483)	Koppers Co., Inc.	80,000[4]	2,000,000
Dodecyl Mercaptan:			
Naugatuck, Conn. (543)	U.S. Rubber Co.	2,400	60,000

[1] Butadiene, styrene, dodecyl mercaptan capacities in short tons annually; GR-S copolymer and butyl rubber capacities in long tons annually.
[2] Shell bid $30,000,000 for three plants—butadiene, styrene and GR-S copolymer.
[3] Equivalent butadiene (crude butadiene and butylenes).
[4] Plant is now maintained in stand-by condition, and will probably continue so.

Who Else for Butadiene, Styrene?

Unsuccessful bidders might still be thinking of expanding in these petrochemicals

WHAT other firms are looking at butadiene and styrene as possible petrochemical ventures? Some clues are given in the amount of interest shown in some of these facilities—and the various plans which the bidders disclosed in their proposals.

Here's a brief rundown on each of the unsuccessful seekers after the government butadiene and styrene facilities:

Allied Chemical & Dye Corp., bid on the butadiene plant at Port Neches. It proposed to buy butylene feed stock from the present suppliers—Atlantic, Gulf, Pure, Texas, and had "entered negotiations with other suppliers with a view toward obtaining sufficient feed stock for capacity operations." The company indicated it had other ideas in the petrochemical field, since its proposal stated in part that "if butadiene capacity is not contracted for, excess facilities may be converted to other uses."

American Chemical Corp. was formed for the purpose of bidding on the styrene plant at Los Angeles. The company is owned equally by Richfield Oil and Stauffer Chemical, and Richfield proposed to supply propane for the manufacture of the styrene from its Watson refinery, just five miles away. Richfield also proposed to purchase the byproduct propylene from the styrene operation. Richfield stated it was prepared to construct a plant to make benzene at its refinery, if that proved necessary.

Dow Chemical Co. bid on the styrene plant at Los Angeles—which it originally designed and has operated for the past 12 years. As an alternative, it also bid on the group of facilities in the area—styrene, butadiene, and co-polymer. Dow claims to own about 35% of the total styrene capacity in the country, and the acquisition of the Los Angeles plant would have given it nearly 50% of total U.S. capacity. Dow had made no arrangements for raw materials—but presumably would have had little trouble because of its similar requirements at its Texas plants.

Foster Grant Co. likewise bid on the Los Angeles styrene plant. This company is already in the styrene monomer business—although just recently and only to a very small extent. Its plant at Baton Rouge has a design capacity of 6000 tons per year, less than 2% of the total capacity in the country. Foster Grant would have had no supplies of feed stocks under its immediate control—as would have had American Chemical.

Goodyear Synthetic Rubber Corp. perhaps shouldn't be considered an unsuccessful bidder. It was successful on two GR-S plants—at Akron and at Houston. But it also put in a bid for the butadiene plant adjacent to the Houston co-polymer facility. Actually, the company wasn't too interested in the butadiene plant. Its bid was the lowest for that facility, and the company frankly stated "it had no particular desire to enter the butadiene business as such." The bid was entered solely to put Goodyear in a position to negotiate for the plant and protect its butadiene supply in the event it appeared that the plant would not be sold to some responsible party.

W. R. Grace and Co. bid on three plants: butadiene facility at Houston, butadiene facility at Port Neches, and the Los Angeles styrene works—and lost out on all three. For either of the butadiene plants (Grace wanted only one) the company was studying available butylene supplies. As an alternative, the company was giving consideration to the erection of a Houdry dehydrogenation unit for converting normal butane to butylene. Nothing was said about raw materials for the styrene facility.

Hercules Powder Co. bid for the L. A. styrene plant. For its needed supply of benzene (estimated at 15 million gal./yr. at capacity operation) the company planned to recover about 6 million gal./yr. by refining crude

They Were All After the Butadiene, Styrene Units

Most interest was shown in the butadiene and styrene units of the synthetic rubber facilities. Here's a list of the prospective purchasers, and of their first offers—which gives some idea of just how interested they were. First company under each plant was the ultimate successful bidder, with its final bid in parentheses. All bids are in millions of dollars.

Butadiene, Pt. Neches
(190,000 ST/Yr.)

Goodrich-Gulf—Texas-U.S.Rubber	$51.0	($53.0)
Allied Chemical & Dye	38.5	
W. R. Grace	33.2	

Butadiene, Houston
(90,000 ST/Yr.)

Food Machinery and Chemical	$11.0	($24.2)
Goodrich-Gulf Chemicals*	7.6	
Goodyear Synthetic Rubber	5.0	
W. R. Grace	8.1	
Sinclair Refining	16.0	

Butadiene, Lake Charles
(63,000 ST/Yr.)

Petroleum Chemicals	$15.1	($16.0)
Merck & Co.—Climax Molybdenum	10.1	

Butadiene, Baytown
(46,000 ST/Yr.)

Humble Oil & Refining	$7.9	($8.9)
Food Machinery & Chemical*	6.6	

Butadiene, Los Angeles
(48,000 ST/Yr.)

Shell Chemical**	$27.0	($30.0)
Dow Chemical**	17.5	
Edwin W. Pauley	4.0	
Standard Oil Co. of Calif.	5.0	

Styrene, Los Angeles
(62,500 ST/Yr.)

Shell Chemical**	$27.0	($30.0)
American Chemical	13.5	
Dow Chemical	12.5	
W. R. Grace	5.8	
Foster Grant	16.1	
Hercules Powder	10.0	
Heyden Chemical	6.3	
Monsanto Chemical	5.8	
Montrose Chemical	4.0	
National Lead	4.0	
Standard Oil Co. of Calif.	6.0	

* This bid was an alternate, on the chance the company's first choice for a plant was not successful.
** This bid was for the three plants in the Los Angeles area as a group—butadiene, styrene, GR-S.

light oil from coke oven operations, and to purchase the balance on short term contracts. Propane (estimated at 30 million gal./yr. at capacity operation) was to have been purchased from one or more of the nearby refineries—Shell, Standard of California, General Petroleum, Union or Richfield.

Heyden Chemical Co. was another bidder for the Los Angeles styrene plant. Although the company had made no arrangements for raw materials it was "considering the advisability of replacing propane with another feed stock believed to be available in the area which would utilize the existing propane cracking facilities but with indicated cost and quality advantages over propane." The alternate feed stock was not identified further.

Merck & Co and Climax Molybdenum jointly bid on the butadiene plant at Lake Charles and proposed to organize a subsidiary to operate it. Cities Service had indicated its willingness to supply necessary feed stocks from its nearby refinery for a minimum of five years.

Monsanto Chemical Co. bid on the styrene plant at Los Angeles. The company already operates what is probably the largest single styrene plant in the U.S.—at Texas City, Texas, with a capacity of 140,000 tons/yr., about 30% of total U.S. capacity. The company had made no advance arrangements for feed stocks, and stated in its bid that it had no plans for using the facilities other than for styrene production.

Montrose Chemical Co. was another bidder for the popular Los Angeles styrene plant. It announced no plans for raw materials other than to utilize the present ones, and stated it had no intention of using any part of the facility for any other purpose.

National Lead Co. bid on both the styrene and co-polymer facilities at Los Angeles, contingent on the sale of the adjacent butadiene plant. It divulged no plans, however, for securing raw materials or disposal of products.

Edwin W. Pauley was the only individual to bid on any of the facilities. He offered $4 million for the butadiene plant at Los Angeles. Pauley, jointly with Midland Rubber Co. and Minnesota Mining and Manufacturing, also bid on the co-polymer plant at Los Angeles.

Sinclair Refining Co. put in a bid for the 90,000 ton/yr. butadiene plant at Houston, which it has been operating through its subsidiary synthetic rubber company since the plant was built. Feed stock for the production of 41,000 tons/yr. of butadiene would have been available from Sinclair's nearby refinery, but the company did not commit itself to make that feed stock available to any other purchaser. It was contemplated that additional feed stocks as required to run the plant up to its capacity would be purchased on the outside.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Methanol

Methanol, pronounced "meth - ah - knoll," has long been a petrochemical, although its original source is evident from one of its commercial synonyms, "wood alcohol." Also known as methyl alcohol, it has the formula CH_3OH, which means an alcohol group attached to a methyl radical; is a clear, colorless, volatile, flammable liquid; and is lighter than water and of lower freezing and boiling points.

Methanol finds commercial use as an antifreeze; in the synthesis of formaldehyde, pentaerythritol, methylamines, and many other chemicals; is a solvent (including use in petroleum treating); as a denaturant for ethyl alcohol; etc.; a complete list of uses would fill a book. However, among the more promising newer applications is the use of methanol by jet aircraft (to increase the density of the jet during takeoffs and thus to provide more thrust for the engine).

Commercially, methanol is synthesized in several ways, but chiefly under high pressures; catalytically; from carbon monoxide and hydrogen, in turn derived from the reaction of natural gas or petroleum fractions with steam ("methane-steam reaction") or oxygen (partial oxidation). A variant of the partial-oxidation reaction is used by a few companies to produce methanol directly, in admixture with other oxygenated hydrocarbons. Methanol will also be a by-product from the synthesis of gasoline by the Synthine (Fischer-Tropsch) process when a plant using natural gas as raw material resumes production this year.

While production capacity for this large-volume petrochemical may exceed demand for a few years, because of shrinking demand for use as antifreeze and the erection of additional plants, forecasters predict long-range over-all growth in the use of this material. Methanol has long since shed its "wood alcohol" connotations and has become an exceedingly important industrial petrochemical.

Ferrocene

Ferrocene, pronounced **"fair**-ah-seen," is a petrochemical less than three years old, but one which may well have a really intriguing future. Chemically known as bis(cyclopentadienyl)iron, it is a solid, orange-to-yellow material with the formula C_5H_5-Fe-C_5H_5 (each atom of iron is connected to two cyclopentadienyl radicals). Ferrocene melts at about 343° F. but begins to sublime (pass straight from the solid to the gaseous state, with no apparent liquefaction) at about 212° F., without decomposition. It is stable material with apparently low toxicity.

Synthesis of ferrocene is said to involve the reaction of ferrous chloride ($FeCl_2$) with the sodium salt of cyclopentadiene. Other variations involving reaction of cyclopentadiene with iron in the presence of oxide catalysts, etc., are possible.

Interest in ferrocene is based on its reported ability to promote the virtually smokeless combustion of hydrocarbons—fuel oil, etc. Concentrations of as little as 0.05% by weight are said to reduce carbon formation in heating oils by as much as 40%. Use in jet-aircraft fuel is also indicated. On the horizon is possible use as a gasoline antiknock. But here ferrocene, while reportedly possessing excellent antiknock properties, good stability, and low reactivity, also is said to encounter the same difficulties which confront iron carbonyl—formation of highly abrasive iron oxide upon decomposition in engine cylinders.

Cyclopentadiene, the organic-chemical part of ferrocene is a product of the catalytic reforming of naphthas, and is also available from coal tar. Raw material costs for large-scale production will thus not be excessive. It will be interesting to see if this product—still in the early stages of development—lives up to the enthusiastic forecasts of companies active in the study of its use.

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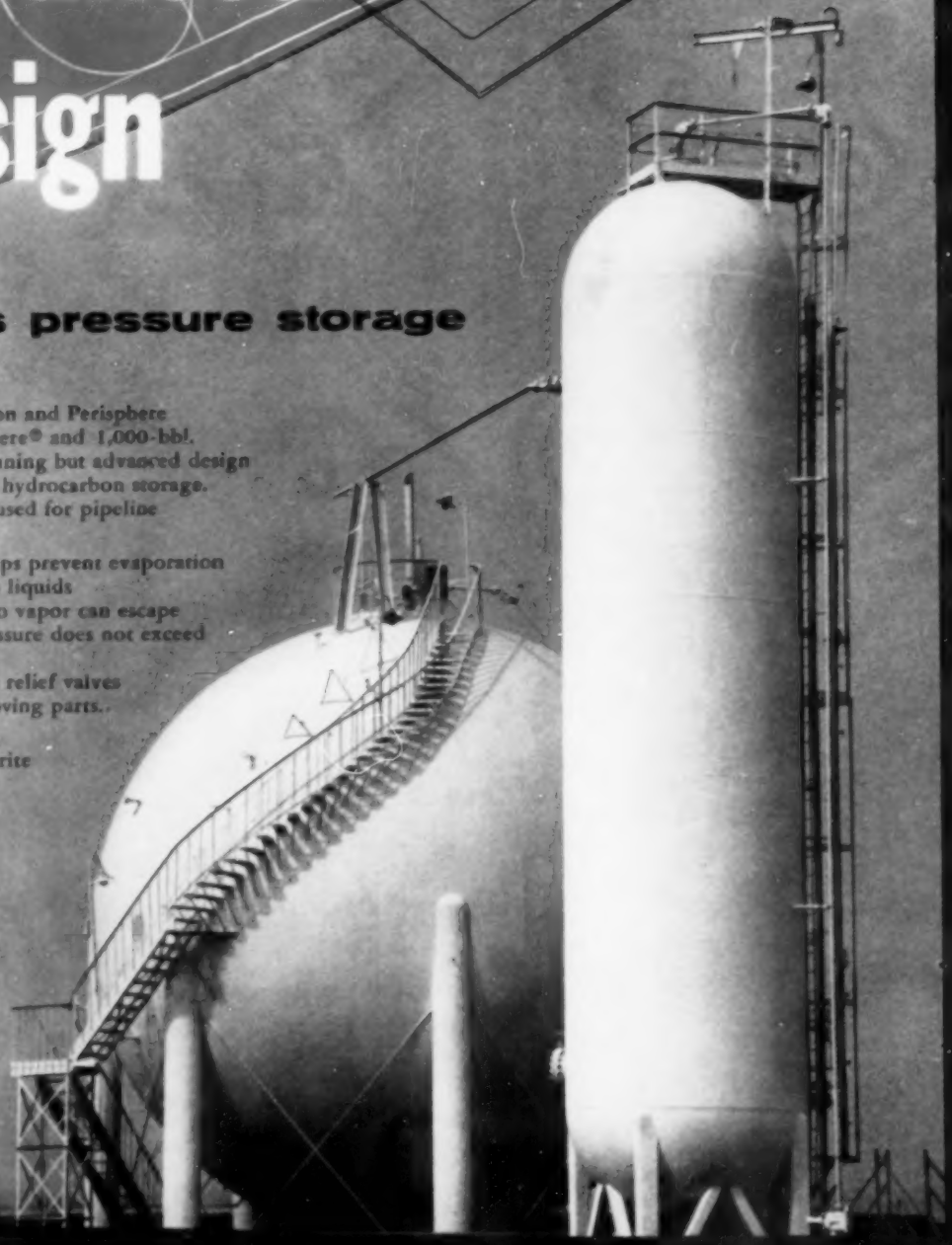

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TANK CAR SCAFFOLD at Dow Chemical Co.'s Freeport, Texas plant

Scaffold Speeds Work on Tank Cars

A TANK car scaffold which provides a sturdy platform for exterior work on railroad tank cars has been developed by the paint shop at the Freeport, Texas, plant of Dow Chemical Co. Shown in the photograph, it is constructed of angle-iron and reinforcing plates and has a plank catwalk and back railing. It is slightly more than half the length of the tank on the standard car. Disassembly of the scaffold for portability is simply accomplished.

The catwalk is supported at both ends and the center, and a hook is welded onto the front vertical member of the catwalk support to hook over the handrail of the car. This is the principal support for the scaffold.

On the bottom of the catwalk supmember is an adjustable thrust-screw, the end of which bears on the car's tank. By adjusting this screw the catwalk may be leveled.

The catwalk timber may be one or two 2 x 12's. The support rail is 2 x 4. Access to the scaffold is by the ladders permanently installed on the car.

More "Mileage" from Plug Valves

PLUG valves are popular because of their simple construction, quarter-turn closure, tight seal and ease of operation. To get maximum service out of these valves, engineers of Rockwell Manufacturing Co.'s Nordstrom Valve Division have assembled the following tips on plug valve servicing.

Plug adjustments should be snug—tight enough to keep the plug from becoming unseated, but not to a degree requiring excessive force to operate the valve.

Periodic, systematic lubrication with the proper grade of lubricant is recommended.

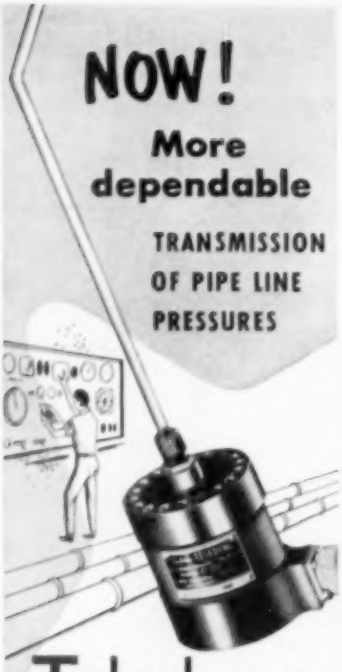
Keep valve lubricant system full with a fresh supply of lubricant. It can be forced easily between the seating surfaces by giving the lubricant screw a few turns.

Lubricant depletion in the valve lubrication system will require the addition of several sticks before lubricant can be forced into the seat. Lubricant should be added until increased resist-

ance is felt in turning the lubricant screw, or until there is increased pressure when gun lubrication is used.

Turn plug slightly when lubricating to assist in the distribution of lubricant and to determine if the adjustment is correct. If the valve is lubricated with the adjustment too loose, efficient lubrication cannot be obtained. Further, the valve may be permanently unseated allowing the lubricant to quickly dissipate and the valve may leak.

If valves are over-lubricated with the adjustment too lose, it can be corrected by alternately tightening the adjustment and turning the plug. This will work out excess lubricant, permitting the plug to return to its proper position in the seat.



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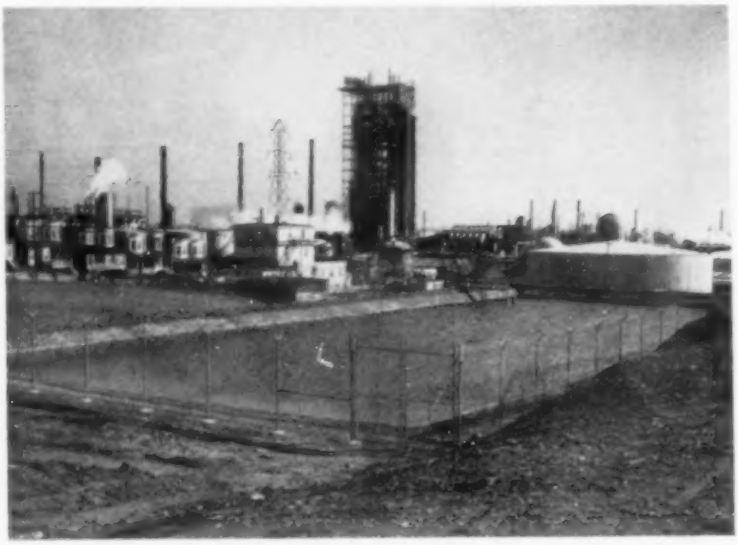

EMERGENCY WATER RESERVOIR at Sun Oil Co.'s Marcus Hook, Pa. refinery

Fish Stop Mosquitos in Reservoir

THE EMERGENCY water reservoir at Sun Oil Company's Marcus Hook, Pa. refinery, completed in 1950, was a potential breeding ground for mosquito larvae.

Because the reservoir is near the residential section of Linwood, Sun engineers decided to take steps to prevent insect breeding in their reservoir by the use of larvae eating fish.

The reservoir is 225 ft. long, 125 ft. wide, and 10 ft. deep. It's purpose is to supply emergency water to fight fires in nearby plants or in the nearby community of Linwood.

First thoughts were to spray the water with insecticides to kill insect larvae—but the disadvantages of repeated sprayings on the water, especially in warm weather, discouraged this approach.

After consultation with limnologists at Philadelphia's Academy of Natural Sciences, Sun decided to utilize the fish species of *Gambusia Affinus. Gambusia*, a minnow of the warmer parts of North America and the West Indies, feeds principally upon aquatic larvae as well as scavenging organic wastes from the water.

Unfortunately, the cool climate discouraged reproduction among the *Gambusia*. So, in July, 1951, about a dozen each—male and female—of green sunfish and bluegills were obtained from the Philadelphia Academy of Natural Sciences to augment the *Gambusia* forces.

Today, the refinery reservoir is clear and reasonably free of breeding mosquitos. The bluegills and green sunfish are flourishing in the pool, but the *Gambusia* has not been seen in the pool for a long time.

The preceding article is based on information contained in the Autumn 1954 issue of "Our Sun," published by the Sun Oil Company.

(To obtain more data on advertised products see page 404)

WHEN HEAT MUST BE ENCLOSED

In the old days some grate bars and a brick wall were the prime materials needed for a heat enclosure. Today industry demands higher temperatures, lower heat loss and greater efficiency.

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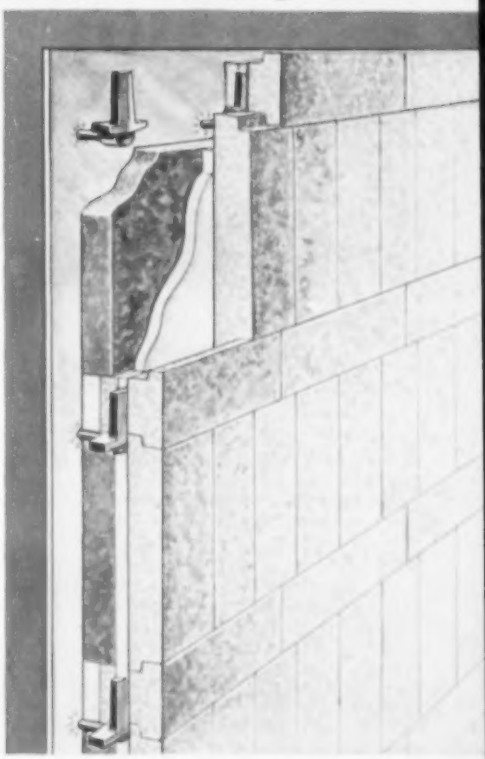

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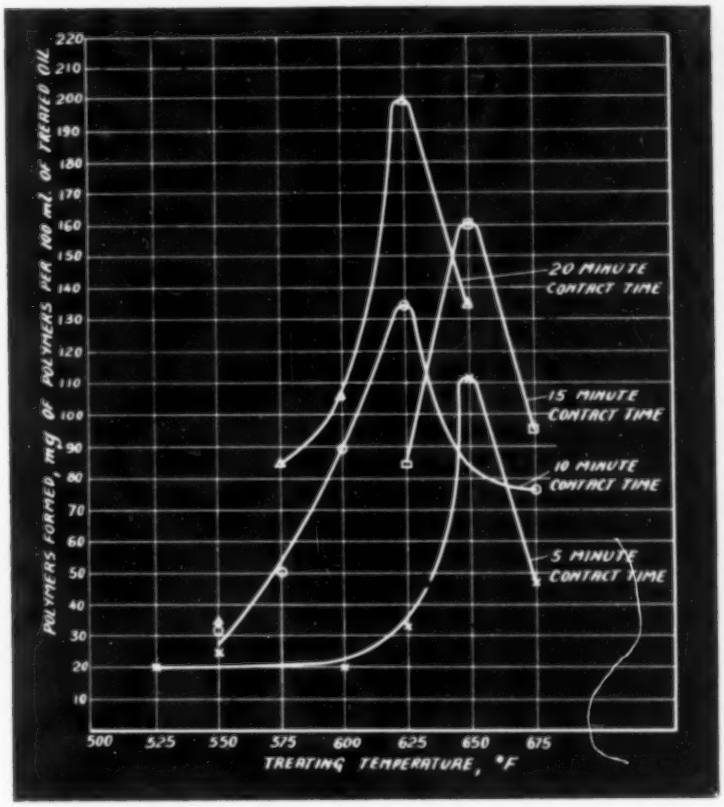
By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.



UNSTABLE IMPURITIES taken out of a light mineral oil by contact with aluminum fluoride catalyst for different lengths of time.

Catalyst Will Stabilize Mineral Oils Against Gum Formation

CATALYTICALLY cracked light mineral oils useful as blending stocks for gasoline, diesel oils, and distillate furnace oils tend to render the blended products very unstable in storage, especially if the oil is in contact with air, as is always the case when a fuel tank is maintained in a partially filled condition. The problem is particularly acute in connection with distillate fuels such as No. 2 fuel oil.

This instability evidences itself in an increase in the soluble gum content of the oil, the formation of an insoluble gum precipitate, and a darkening in color of the oil. The gums tend to settle out and clog the screens, strainers, filters, or conduit lines of the equipment in contact with the fuel, which necessitates frequent shutdowns for cleaning or replacement of parts.

The cause of the instability has not been definitely determined, but various investigators have attributed it to sulfur compounds, unstable nitrogen compounds, particularly the pyeroles, colloidal carbenes and carboids, or unstable diolefinic compounds.

Proposals have been made, as in U. S. patent No. 2,527,987, to maintain such gumming materials in suspension by use of certain additives, thereby avoiding the plugging of screens and filters. Such an expedient, although useful in some ways, is said to be ineffective in preventing deterioration of the color of the oil, so that an off-colored product still results. This problem is not serious during fall and winter months when furnace oils move to the consumer without undue delay. It does become serious for oil produced during spring and summer months, which, of necessity, must be kept in storage until the next heating season.

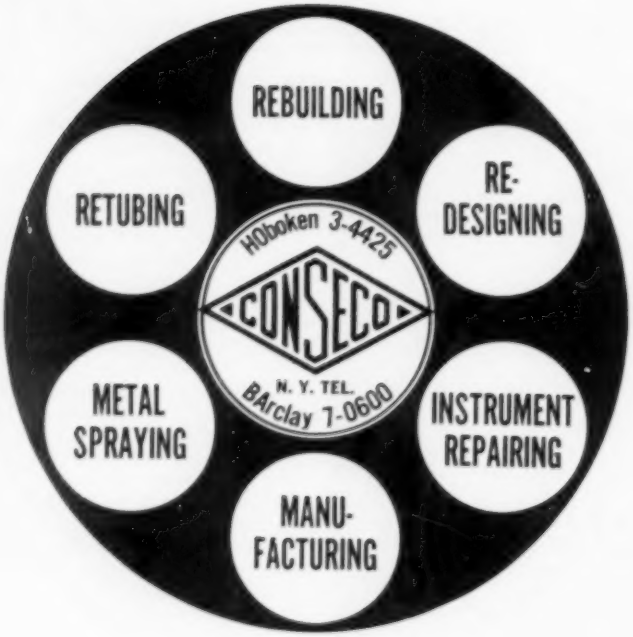
Processes also have been proposed for treating unstable oils with catalysts, such as aluminum halides or boron fluoride, at low or atmospheric temperatures to polymerize the olefins in the oils. But such processes, although they remove a portion of the olefin content and improve the stability to some degree, are claimed to be ineffective in removing other gum and sludge-forming constituents and do not appear to have gone into commercial production.

In U. S. patent No. 2,666,021, Cities Service Research & Development Co. proposes to treat such unstable cracked oils so as to render them them stable in storage over long periods of time, with little gum or sludge deposition, and with no appreciable darkening in color. A stable oil is considered to be one in which soluble gum content does not increase by more than 20 mg./100 c.c., or the insoluble precipitate does not increase more than 2 mg./100 c.c. in 12 months' storage.

The treatment involves contacting the liquid hydrocarbon, for a period of two minutes or longer, with a catalyst comprising aluminum fluoride at elevated temperature and pressure sufficient to prevent vaporization of the oil. The optimum treating temperature must be at about the end boiling point at atmospheric pressure, and preferably within 50° F. of that temperature. For commercial operations, a 2-min. contact is sufficient, the product recovered having a light straw color acceptable in a first quality furnace oil. But, if an even lighter color is desired, treating time should be increased. With a 10 to 20-min. contact time, a product is claimed to be made which, on fractionation, will yield up to 85% recovery of a water-white oil showing no color degradation or increase in gum content when stored in an oven at 110° F. for 12 weeks.

The preferred catalyst is aluminum fluoride (AlF_3 3 HF) supported on silica gel, applied as a 7% aqueous solution, after which the catalyst is dried, calcined at 1000° F. for two to four hours, yielding a product containing about 4% AlF_3.

The illustration is a set of curves showing the quantity of unstable impurities removed from a light cycle oil (A) by treatment at various temperatures and with varying contact times. It will be noted that maximum polymer formation at all treating times



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showed a very definite peak at 625° to 650° F., near the end boiling point of the oil (666° F.).

Patents Issued in January

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U. S. Patent Office for January 4, 11, 18, and 25, 1955, Vol. 690, Nos. 1-4.

PROCESSES

Refining

2,698,831 (Pan American Refining Corp.) Aromatic recovery process, using phenol extraction.
2,698,870 (Universal Oil Products Co.) Separation of branched chain hydrocarbon from mixtures containing cyclic and straight chain components, using urea, etc.
2,699,420 (Standard Oil Co.-Ohio) Treatment of corrosive light hydrocarbons by contacting with mercaptide salt of Zn and Pb.
2,699,422 (Phillips Petroleum Co.) Separation of nitrogen-substituted hydrocarbons of the aza type from hydrocarbons by azeotropic distillation with perfluorinated compound.
2,699,836 (Phillips Petroleum Co.) Separation of gases by diffusion.
2,700,016 (Carl Naumann) Distillation of high boiling hydrocarbons and products therefrom.
2,700,024 (Cities Service Research & Development Co.) Process of breaking emulsions.
2,700,061 (Phillips Petroleum Co.) Method of preparing silica adsorbent material and using it for selectively adsorbing aromatic hydrocarbons.
2,700,612 (Universal Oil Products Co.) Stabilization of organic materials with N,N'-di-sec-butyl-p-phenylene diamine salt.
2,700,637 (Standard Oil Development Co.) Process for the removal of asphaltic constituents from residual oils by contacting with Co-Cu hydrocarbon and cycle oil.
2,700,643 (Martin R. Kroger) Method for the fractionation of mixtures containing dicyclopentadiene and other materials.
2,700,664 (Phillips Petroleum Co.) Separation of organic compounds by urea adduct formation.
2,700,690 (Standard Oil Development Co.) Removal of saponifiable sulfur compounds from hydrocarbons with activated carbon.

Catalysts

2,699,256 (Shell Development Co.) Fractionation of microporous solids.
2,699,430 (Sinclair Refining Co.) Silica-magnesia catalyst and its method of manufacture.
2,699,376 (Gulf Research & Development Co.) Process for increasing the average pore size of a calcined silica gel.

Conversions

2,698,672 (Standard Oil Development Co.) Cyclone separator for separating solid particles from gaseform mixtures.
2,698,746 (Lummus Co.) Solids flow regulator.
2,698,782 (The Texas Co.) Preparation of motor gasoline from carbonaceous feed material, using reaction with oxygen at 2000° F.
2,698,829 (Universal Oil Products Co.) Two-stage process for the catalytic conversion of gasoline, using hydrocracking with Pt catalyst.
2,698,830 (Texaco Development Corp.) Hydrocarbon conversion process, using hot stream of CO and hydrogen.
2,698,867 (The Texas Co.) Hydroxy aromatic hydrocarbon-olefin polymer alkylation with HF catalyst.
2,698,869 (Sun Oil Co.) Dealkylation of monomethyl naphthalene.
2,699,363 (Houdry Process Corp.) Method for elevating granular material.
2,699,457 (Karl Ziegler & Hans-Georg Gellert, Mulheim, Ruhr, Germany) Polymerization of ethylene with metal alkyl compound activator.
2,699,989 (Oxy-Catalyst, Inc.) Catalytic units and apparatus.
2,700,013 (Houdry Process Corp.) Catalytic upgrading antiknock value of gasoline and naphthas, using silicious catalyst containing molybdenum oxide.
2,700,014 (Gulf Research & Development Co.) De-

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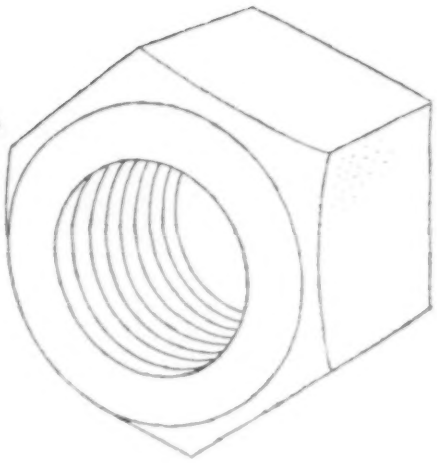


In refinery bolting, with its extremes of temperatures and pressures, there's no such thing as a super nut, which can be used at will. Instead, engineers choose from several grades of nuts to be sure of economical performance in all locations.

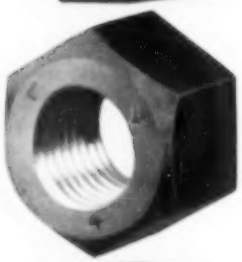
To meet the varying conditions encountered in refinery bolting, Bethlehem produces four grades of hexagonal nuts, each meeting the requirements of ASTM Spec. A-194. They are tapped to Class 2 fit, and come in sizes from ⅜ in. to 2 in. For full particulars, get in touch with the nearest Bethlehem office.

Grade 2

A medium-carbon-steel nut, for use where temperatures and pressures are moderate. Carbon 0.40 min, Phosphorous 0.05 max, Sulphur 0.05 max, Brinell hardness 160 min. Carried in stock.

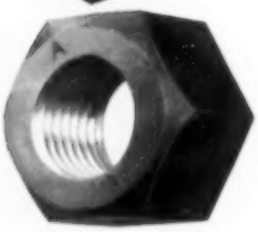
Grade 2H

A quenched and tempered carbon-steel nut. Withstands high temperatures and high pressures. Carbon 0.40 min, Phosphorous 0.05 max, Sulphur 0.05 max, Brinell hardness 248 to 352. Carried in stock.



Grade 4

This heat-treated molybdenum-steel nut is ideal for severe temperatures and pressures. Can also be used for sub-zero temperatures, as it has a minimum charpy impact value of 15 ft-lb down to −150 F. Carbon 0.40 to 0.50, Manganese 0.50 to 0.95, Phosphorous 0.04 max, Sulphur 0.05 max, Silicon 0.15 min, Molybdenum 0.20 min, Brinell hardness 248 to 352.



Grade 1

Low-carbon steel. Intended for non-critical bolting, but can also be used in installations involving moderately elevated temperatures. Carbon 0.15 min, Phosphorous 0.05 max, Sulphur 0.05 max, Brinell hardness 120 min. Carried in stock.

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BETHLEHEM BOLTS AND NUTS

BETHLEHEM STEEL

structive hydrogenation of hydrocarbon mixtures containing difficult to vaporize components.
2,700,015 (Gulf Research & Development Co.) High pressure fluid hydrogenation process.
2,700,017 (Standard Oil Development Co.) Method of coking residual hydrocarbons, using fluidized turbulent bed of finely divided solids.
2,700,018 (Standard Oil Development Co.) Fluidized distillation of oil shale by direct heating with a heated liquid spray.
2,700,591 (The Dorr Co.) Method of carrying out endothermic reactions under fluidizing conditions.
2,700,595 (Standard Oil Co.—Ind.) Fluid inlet for suspended solids contacting.
2,700,598 (Standard Oil Development Co.) Process for reforming hydrocarbons in fluidized system.
2,700,599 (Hydrocarbon Research, Inc.) Gasification of solid carbonaceous materials in fluidized system.
2,700,600 (William W. Odell) Process of treating gas in fluidized system for conversion without production of carbon black.
2,700,638 (Sinclair Refining Co.) Combination cracking process for producing aromatics from petroleum.
2,700,639 (Standard Oil Development Co.) Fluid hydroforming.
2,700,640 (Shell Development Co.) Method and apparatus for contacting vapors with fluidized solids.
2,700,642 (Standard Oil Development Co.) Coking of heavy hydrocarbonaceous residues in fluidized system.
2,700,644 (Universal Oil Products Co.) Conversion of hydrocarbonaceous reactants in a fluidized bed of particulated solid material.
2,700,663 (Standard Oil Co.—Ind.) Polymerization of low molecular weight olefins with acetylene treated molybdena catalysts.

Hydrocarbon Synthesis

2,698,862 (Standard Oil Co.—Ind.) Hydrogenation of carbon monoxide utilizing an alloy catalyst.
2,699,383 (Gulf Research & Development Co.) Synthesis gas manufacture.
2,699,384 (Du Pont Co.) Preparation of carbon monoxide and hydrogen from carbonaceous solids.
2,699,986 (Phillips Petroleum Co.) Manufacture of hydrogen, using iron, steam and hydrocarbons.
2,699,988 (M. W. Kellogg Co.) Apparatus for synthesis of organic compounds.
2,700,049 (Walter Roetig; Oberhausen-Sterkrade-Nord, Germany) Extraction of oxygen-containing compounds from reaction mixtures containing the same.
2,700,676 (M. W. Kellogg Co.) Synthesis of organic compounds.

PRODUCTS

Chemicals

2,698,841 (Standard Oil Development Co.) Reaction product of an olefin-diolefin resin with a cyclodiolefin.
2,698,848 (Phillips Petroleum Co.) Making pyridine derivatives.
2,698,863 (Shell Development Co.) Peresters of oxo-substituted poly-peroxycarboxylic acids.
2,698,864 (Universal Oil Products Co.) Carboxy alkylbenzene sulfonic acids and carboxynitroalkylbenzene sulfonic acids and alkali metal salts thereof.
2,699,454 (Standard Oil Development Co.) Synthesis of octlyl alcohol.
2,700,050 (Gulf Research & Development Co.) Separation of oxidation products of 15-30 C. paraffins, using alcohols.
2,700,052 (M. W. Kellogg Co.) Preparation of sulfonated detergent compositions.
2,700,673 (Socony-Vacuum Oil Co.) Thiophenated ketones.
2,700,677 (Celanese Corp. of America) Oxidation of hydrocarbons in vapor phase.
2,700,687 (Standard Oil Development Co.) Desulfurization of oxo alcohols.
2,700,689 (Standard Oil Co.—Ind.) Disproportionation of mono- and dibetiary-butylbenzenes.

Fuels

2,698,510 (Phillips Petroleum Co.) Method and fuel for operating pulse-jet engines and protectively coating valves of such engines, containing over 10% isoparaffins, over 50% n-paraffins and metal salt of 1-20 C. acid.
2,698,511-3 (Phillips Petroleum Co.) Method of operating turbojet engines, using iso-normal paraffin mixtures and injecting air at certain Mach Nos., etc.
2,699,385 (Gulf Research & Development Co.) Increasing burning rate of hydrocarbon fuel oil compositions by addition of alkoxy alkylated aromatic compound.
2,699,991 (California Research Corp.) Surface-active clogging and corrosion inhibiting compounds and fuel compositions containing them (2[N,N-di (alkylbenzyl)-N-methyl ammonium) ethyl sulfates).
2,700,601-2 (Allied Chemical & Dye Corp.) Process for producing a natural gas substitute from gas oil.

Lubricants

2,698,835 (Socony-Vacuum Oil Co. Inc.) Wax phenol-phosphorus pentoxide reaction products and petroleum oil lubricating fractions containing the same.
2,699,427 (Gulf Oil Corp.) Mineral oil compositions containing corrosion-inhibiting amidic acids suitable for greases.
2,699,429 (Standard Oil Development Co.) Lubricating oil composition containing isopropyl oleate and tributyl phosphate.
2,700,022 (California Research Corp.) Sugar ester-containing lubricant compositions for inhibiting engine deposits.
2,700,623 (Electrofilm, Inc.) Process of bonding solid lubricant to a metal surface by applying thin coating of indium and coating with finely divided lubricant.
2,699,428 (Witco Chemical Co.) Oil soluble soap of polycarboxylic acids suitable for greases.

Specialties

2,698,834 (Atlantic Refining Co.) Lubricant for protection and preservation of automotive tires and wheels, including asphalteres, paraffins and resins.
2,699,381 (Phillips Petroleum Co.) Oil pelleting of carbon black.
2,699,997 (Standard Oil Co.—Ohio) Core oil containing a drying oil and asphaltenes.
2,700,005 (Standard Oil Co.—Ohio) Removal of combustion chamber deposits by solvent sprays ing.
2,700,025 (Brogdex Co.) Wax composition for fruits and vegetables comprising an oil-soluble, heat-reactive phenol-aldehyde resin, a terpene resin, and sugar-cane wax.
2,700,652 (Paul D. Menaul) Inhibiting corrosion due to sulfur compounds by use of water-soluble cyanamide.

EQUIPMENT

Processing General

2,698,524 (Sune Ossian Rygard) Heat transfer between two media according to the Carnot principle.
2,698,669 (Research Corp.) Electrical precipitator.
2,698,672 (Standard Oil Development Co.) Cyclone separator for separating solid particles from gasiform mixtures.
2,698,717 (Surface Combustion Corp.) Apparatus for controlling flow of tar-containing gas.
2,698,740 (Lummus Co.) Solids flow regulator.
2,698,744 (Harry B. Holthouse) Metering unit for liquid fuel burners.
2,698,746 (David G. Reynolds) Vapor-liquid contact apparatus.
2,699,155 (Arthur A. Olson & Co.) Portable fluid heater.
2,699,248 (Houdry Process Corp.) Apparatus for handling granular material.
2,699,249 (Houdry Process Corp.) Apparatus for handling resilient granular material.
2,699,322 (Henry H. Feldstein) Heat exchanger.
2,699,324 (A.P.V. Co. Ltd.) Plate-type heat exchanger.
2,699,379 (Jose A. Lugbe) Extraction apparatus.
2,699,380 (Phillips Petroleum Co.) Pebble-heater for converting hydrocarbons.
2,699,381 (Phillips Petroleum Co.) Apparatus for oil pelleting of carbon black.
2,699,421 (Sinclair Refining Co.) Coking reactor.
2,699,761 (Springfield Boiler Co.) Steam generator.
2,699,762 (Babcock & Wilcox Co.) Vapor-generating unit with a plurality of gas passes therefrom.
2,699,928 (Hans Mayer, et al.) Vaporizer for liquids.
2,699,929 (Socony-Vacuum Oil Co.) Light-weight fractionating tray.
2,699,987 (Phillips Petroleum Co.) Pebble heat exchange chamber.
2,700,375 (Babcock & Wilcox Co.) Fluid-cooled furnace wall.
2,700,376 (Foster-Wheeler Corp.) Apparatus for purifying steam.
2,700,380 (Surface Combustion Corp.) Radiant tube heater and combustion air preheater therefor.
2,700,417 (Clement R. Gilmore) Recirculating vaporizing liquid fuel burner.
2,700,429 (Research Corp.) Electrical precipitator.
2,700,533 (Archer-Daniels-Midland Co.) Cooler for flocculent or granular material.
2,700,594 (Union Oil Co. of Calif.) Apparatus for production of unsaturated hydrocarbons.
2,700,596 (Otto Hubman) Apparatus for the low-temperature carbonization and gasification of combustibles.
2,700,645 (Detrex Corp.) Degreasing apparatus.
2,700,653 (Olin Mathieson Chemical Corp.) Chemical feeder.

Catalytic Reactors

2,699,060 (Sinclair Refining Co.) Catalyst-testing apparatus.
2,699,988 (M. W. Kellogg Co.) Apparatus for synthesis of organic compounds.
2,699,989 (Eugene J. Houdry) Catalytic units and apparatus.

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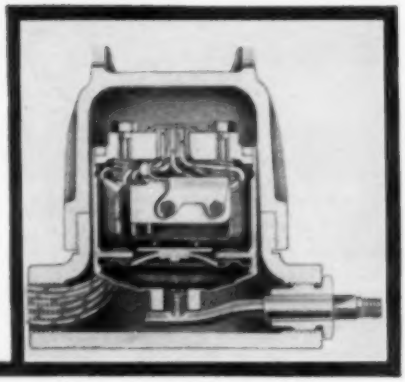

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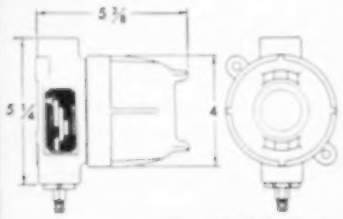

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Patents

2,700,595 (Standard Oil Co.—Ind.) Fluid inlet for suspended solids contacting.
2,700,641 (Shell Development Co.) Apparatus for contacting vapors with fluidized solids.
2,700,644 (Universal Oil Products Co.) Apparatus for converting hydrocarbonaceous reactants in a fluidized bed of particulated solid material.

Instruments

2,698,519 (Electricite de France) Apparatus for measuring a liquid level.
2,698,568 (Garrett Corp.) Pressure control mechanism.
2,699,000 (Teletronics Lab Inc.) Precision gage of extremely high sensitivity.
2,699,001 (M. M. and Jack Kinley) Tubing caliper.
2,699,061 (Sperry Products Inc.) High-speed ultrasonic indicator.
2,699,067 (Anglo-Iranian Oil Co.) Gravimeter.
2,699,068 (Warner & Swasey Research Corp.) Pressure-measuring and recording apparatus.
2,699,069 (Hays Corp.) Fluid pressure gage.
2,699,505 (General Electric Co.) Mass spectrometry.
2,699,523 (Minneapolis-Honeywell Regulator Co.) Liquid-level measuring capacitor.
2,699,653 (Yves Pomar) Apparatus for automatically regulating liquid level.
2,699,673 (Simon-Carves Ltd.) Apparatus for determining particle size distribution.
2,699,678 (Hans Gehre) Gas flow-measuring instrument.
2,699,680 (Garvin J. Ferguson) Liquid sampler.
2,699,800 (Crane Co.) Fluid pressure regulator.
2,700,222 (Oscar J. Swenson) Level responsive apparatus.
2,700,228 (Standard Oil Co.—Ind.) Oil viscosity demonstration device.
2,700,307 (B-I-F Industries Inc.) Device for protecting flow gage from overloads.
2,700,361 (Sebastian Thielmann) Safety device for excess temperatures.

Pumps & Compressors

2,698,576 (Du Pont Co.) Automatic control of interstage pressures in pumps.
2,698,579 (Gemmer Mfg. Co.) Constant delivery pump.
2,698,580 (C.A.V. Ltd.) Pump.
2,698,584 (William Stelzer) Centrifugal pump.
2,698,585 (H-P-M Development Corp.) Radial piston-type hydraulic pump.
2,699,119 (American Instrument Co.) Variable stroke pump.
2,699,122 (General Motors Corp.) Multiple gear fluid pump.
2,699,123 (Denison Engineering Co.) Hydraulic pump or motor.
2,699,725 (Orton T. Quinn) Fluid-pumping apparatus.
2,700,339 (Rialto Corp.) Pump.
2,700,344 (Christopher A. Schellens) Centrifugal hydraulic pump.

Valves & Fittings

2,698,516 (Crane Co.) Pressure valve regulating means.
2,698,631 (Parker Appliance Co.) Level control valve.
2,698,731 (Gustave and Gordon Koehler) Fluid valve.
2,699,124 (Oliver M. Moe) One-way check valve.
2,699,150 (International Harvester Co.) Mechanical and fluid pressure controlled valve.
2,699,152 (Carl D. Russell) Valve mechanism.
2,699,153 (Carl D. Russell) Reversing valve mechanism.
2,699,175 (Hydrocarbon Research) Cold check valve.
2,699,178 (Denison Engineering Co.) Relief sequence and unloader valve.
2,699,179 (Crane Co.) Pressure-actuated valve.
2,699,180 (Dowty Equipment Ltd.) Relief valve with self-aligning seat.
2,699,207 (Charles E. Russell and Chester R. Nichols) Multiple valve and control mechanism therefor.
2,699,316 (Schulz Tool and Mfg. Co.) Fluid level valve.
2,699,317 (Minneapolis-Honeywell Regulator Co.) Valve.
2,699,318 (American Instrument Co.) Flap valve.
2,699,798 (W-K-M Mfg. Co.) Lubricated valve cut-off.
2,699,799 (Robert Hodson Wager) Scavenging air valve for soot blowers.
2,699,842 (Stewart-Warner) Measuring valve.
2,699,869 (General Mills) Electrostatic separator.
2,699,915 (Skinner Chuck Co.) Valve bracket.
2,699,916 (Rockwell Mfg. Co.) Closed bottom service cock.
2,700,365 (Michael Waskiw) Valve signal.
2,700,393 (General Controls Co.) Manual reset valve structure.
2,700,394 (A. V. Roe Canada Ltd.) Flow distributor valve.
2,700,397 (Borg-Warner Corp.) Unloading valve.
2,700,418 (Clement R. Gilmore) Vaporizing-type burner with functional recirculating ring and central stack chamber.
2,700,528 (Glenn R. Blackman) Valve assembly.

(To obtain more data on advertised products see page 404)

William I. Burt, vice-president-manufacturing of B. F. Goodrich Chemical Co., has been elected president of Goodrich-Gulf Chemicals, Inc., a firm owned half by the B. F. Goodrich Co. and half by Gulf Oil Corp. He succeeds **William S. Richardson,** who will continue as a member of the board of directors of the chemicals firm.

With B. F. Goodrich since 1927, Burt became vice-president-manufacturing of B. F. Goodrich Chemical Co., a division of Goodrich, in 1945. Educated at Ohio State University, Burt was manager of the company's chemical plant in Akron, Ohio, general manager of plants, and superintendent of the chemical division before becoming manufacturing vice-president of B. F. Goodrich Chemical Co.

J. B. Willis, asst. to the vice-president for research in the Sinclair Refining Co., has been appointed chief process engineer of Sinclair Chemicals, Inc. Mr. Willis holds a B.S. degree in petroleum refinery engineering from the Colorado School of Mines. He joined Sinclair Refining in 1940. After five years in the U. S. Army he joined their research dept. in the process design div. and in 1950 was transferred to the technical dept. of Sinclair Rubber, Inc., becoming administrative asst. at the Houston plant in 1953. He was appointed asst. to the vice-president for research in 1954.

Charles E. Spahr, vice-president and asst. to the president, has been elected executive vice-president of the board of directors of the Standard Oil Co. (Ohio).

Mr. Spahr

Mr. Tucker

Spahr has been with Sohio since 1939, except for a period during World War II when he saw service in the India-Burma area. After the war he was in various phases of management of the company's transportation department.

Hubert H. Tucker has been appointed director of agricultural service in Sohio's newly organized petrochemical department. Tucker will be with the company's petrochemical plant now being constructed at Lima, Ohio. He comes to Sohio from the position of president of the Coke Oven Ammnia Research Bureau at Columbus.

George R. Bryant has resigned his post of vice-president of The Texas Co. to become president of Jefferson Chemical Co., which is owned jointly by American Cyanamid Co. and Texaco.

Bryant succeeds **P. M. Dinkins,** president of Jefferson Chemical since 1946. Dinkins has retired from the company but will continue to serve in a consulting capacity.

George M. Jones, Jr. and **Edwin Hill** have been appointed asst. project engineers in the engineering div., manufacturing dept., of Sun Oil Co. Jones has been assigned to the electrical and instrumentation project group. He began with Sun in 1939 as an electrician at Marcus Hook, Pa., refinery. He became a draftsman in the manufacturing engineering div. in 1947 and was promoted to engineering asst. in 1952.

Hill has been assigned to one of the general project engineering groups. He joined Sun in 1952 as a draftsman and was appointed an engineering asst. in 1953.

Thomas O. Edwards has been named manufacturing manager of the western division of Tide Water Associated Oil Co., San Francisco. He succeeds **W. P. Hugo** who retired in January after 41 years with the company. Edwards has been manager of the company's refinery at Associated,

THE MOTTIERS in their Cessna-120 over Chicago's lake front

Once-ambitious vacationing is just routine to **Chuck** and **Phyllis Mottier** now that they have their own plane, a Cessna-120. Chuck, an asst. foreman at the Whiting refinery of Standard Oil Co. (Ind.), and his wife began lessons a year ago February. By May they were taking week-end trips of 300 miles or so. When Chuck had 120 hrs. in the air, Phyllis 70, they set off on a two-week jaunt to California. With their plane, they found they were able to get an "iron bird's-eye view" of the west and yet spend no more than one-sixth of the vacation time in flight, although they covered 5560 miles by air. The rest of the time they tred familiar paths of "ground" tourists.

COCKPIT consultation before flight

Calif., 40 miles northwest of San Francisco. **Oscar Larson** is now general manager of this refinery. Larson was formerly asst. general manager.

Thomas P. Simpson has been elected a vice-president and director of manufacturing of the General Petroleum Corp. He had been asst. director of manufacturing since 1953.

Mr. Simpson

Simpson joined General Petroleum as a chemical engineer in 1924, soon after his graduation from California Institute of Technology. In 1935 he was transferred to the Socony-Vacuum Oil Co. as chief development engineer in the Socony-Vacuum Laboratories. He became director of Socony's research and development dept. in 1947 and returned to General Petroleum, Socony's western affiliate, in 1953.

W. Alton Jones, Cities Service Co., has been chosen to serve as chairman of the board of Petroleum Chemicals, Inc., a firm owned jointly by Cities Service and Continental Oil Co. President of the new firm is **L. F. McCollum,** Continental Oil Co.

Vice-presidents in the new firm are **A. P. Frame,** Cities Service, and **Harold G. Osborn,** Continental Oil Co. **B. R. Johnstone,** Cities Service, is secretary and treasurer. The two assistant secretaries are **Keith Blinn,** Continental, and **C. B. Wedum,** Cities Service.

Jones, McCollom, Frame, and Osborn also have been elected to the board of directors. Continental's other representatives on the board of directors are **E. F. Battson, Charles A. Perlitz, Jr., L. C. Peters,** and **Dr. John E. Kircher.** Other board members from Cities Service are **B. S. Watson, G. L. Mateer, H. L. O'Brien,** and **W. H. Price.**

F. M. Simpson remains vice-president and general manager of Petroleum Chemicals. He formerly was president of the Cit-Con Corp., Lake Charles, La.

Personnel changes within Cities Service are as follows:

A. P. Frame has been elected to the board of directors. **M. F. Wirges** has been appointed manager of the company's natural gasoline-chemical div. He joined the company in 1946 as a member of the chemical laboratory staff at Tallant, Okla. He was transferred to Bartlesville as a chemical engineer in 1949 and was named chief process engineer in 1954. **Brenton O. Buck** was advanced to the post of senior process engineer at Bartlesville.

H. J. Morsman, Curacao, N. W. I., has been appointed process superintendent for the Great Northern Oil Co., St. Paul, Minn. Morsman was with Royal Dutch Shell for the past 18 years as first asst. refinery superintendent.

Mr. Morsman

C. W. Gilmore, process engineer for Union Oil Co. of Calif. since 1947, has joined Great Northern as senior process engineer. **Robert J. Johnston** has been named process engineer. Johnston has been with Socony-Vacuum in East Chicago, Ind., for the past two years.

Mr. Gilmore

Mr. Johnston

Frank A. Buehler has been named asst. head engineer in the process engineering div. of Standard Oil Co.'s (Ind.) general engineering dept. Buehler joined the department in 1946. He is a graduate of Purdue University in mechanical engineering.

H. S. Conway and **R. A. Dinerstein** were named section leaders in the analytical research div. of Indiana Standard's Whiting, Ind., laboratories. Conway did both undergraduate and advanced work at the University of Chicago. He has been with the company since 1947. Dinerstein received his bachelor's degree at City College of New York and his master's at Pennsylvania State College. He joined Standard as a chemist in 1946.

J. E. Barney II and **F. J. Piehl** were appointed group leaders reporting to Conway. Barney obtained his undergraduate and graduate degrees in chemistry at Kansas University. In 1950 he was employed by Standard. Piehl was awarded his doctorate at the University of Chicago in 1952 and joined the company the same year.

J. C. Winters has been appointed group leader under Dinerstein. He took his undergraduate and graduate degrees at Kansas State College and has been with Standard since 1950.

J. G. Tolpin has been named technical assoc. in the information development div. He attended the University of Kiev in Russia, the University of Jena in Germany, and Columbia University, where he received an M.A. in chemical engineering. He has been with the company since 1947.

R. L. Hutchinson, formerly general superintendent of Columbia-Southern Chemical Corp., has been appointed general manager of operations. He will assume some of the engineering responsibilities previously handled by **Dwight R. Means,** who is reducing his work schedule to a half-time basis and will assume consulting duties with the firm.

Other technical responsibilities being relinquished by Means will be taken over by **J. A. Neubauer,** technical director.

C. K. Ballard, formerly works manager at the Lake Charles, La., plant, has been made manager of production for the company. His post at Lake Charles has been taken by **A. T. Raetzsch,** who was superintendent of operations.

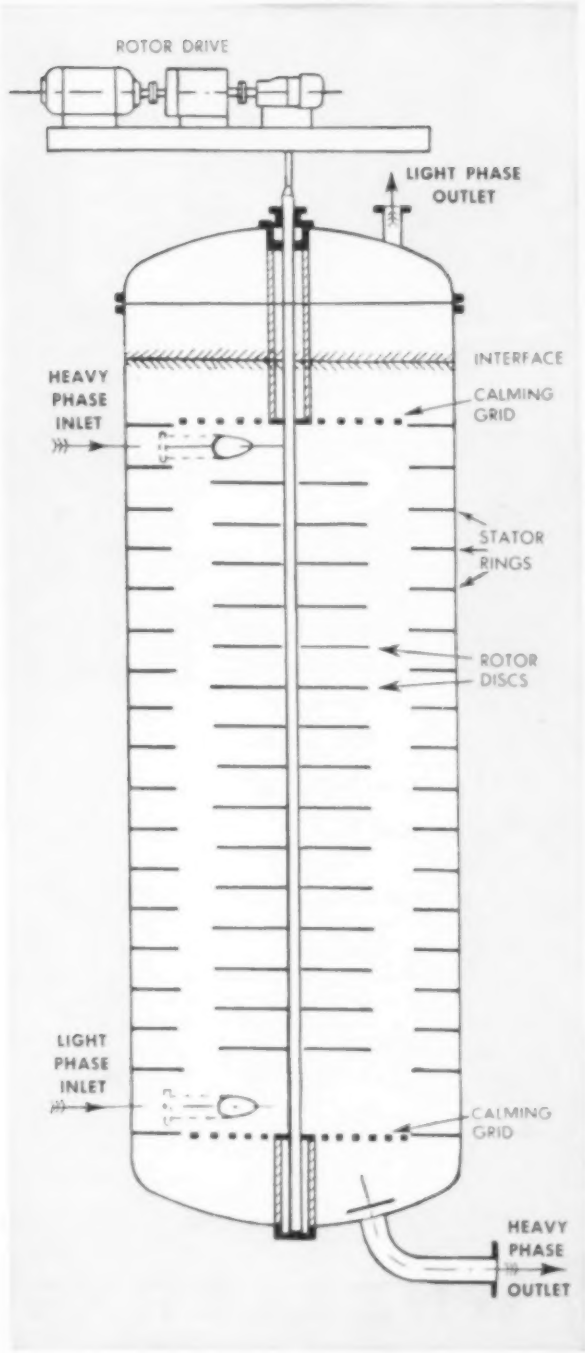
N. J. Ehlers, assistant to the general superintendent of the company, has been appointed asst. technical director.

Dr. David T. Mowry has been named manager of the fine chemicals section, development dept., of Monsanto Chemical Co.'s organic chemicals div. His predecessor, **R. S. Shumard,** has resigned.

Mowry joined Monsanto in 1941 as a research chemist in the central research dept. In 1952 he became manager of chemical development in what is now the inorganic chemicals div., and in 1954 he was transferred to the organic development dept., where he has been active in the company's petrochemicals program.

In Monsanto's Mobay Chemical Co. two group leaders have been appointed in the research dept. **Dr. W. R. McElroy** has been named head of the process development group investigating processes for products and intermediates. **Andrew S. Morecroft** has been named head of the isocyanate foam group concerned with applied research on flexible and rigid foam systems.

RDC improves extraction efficiency, cuts cost



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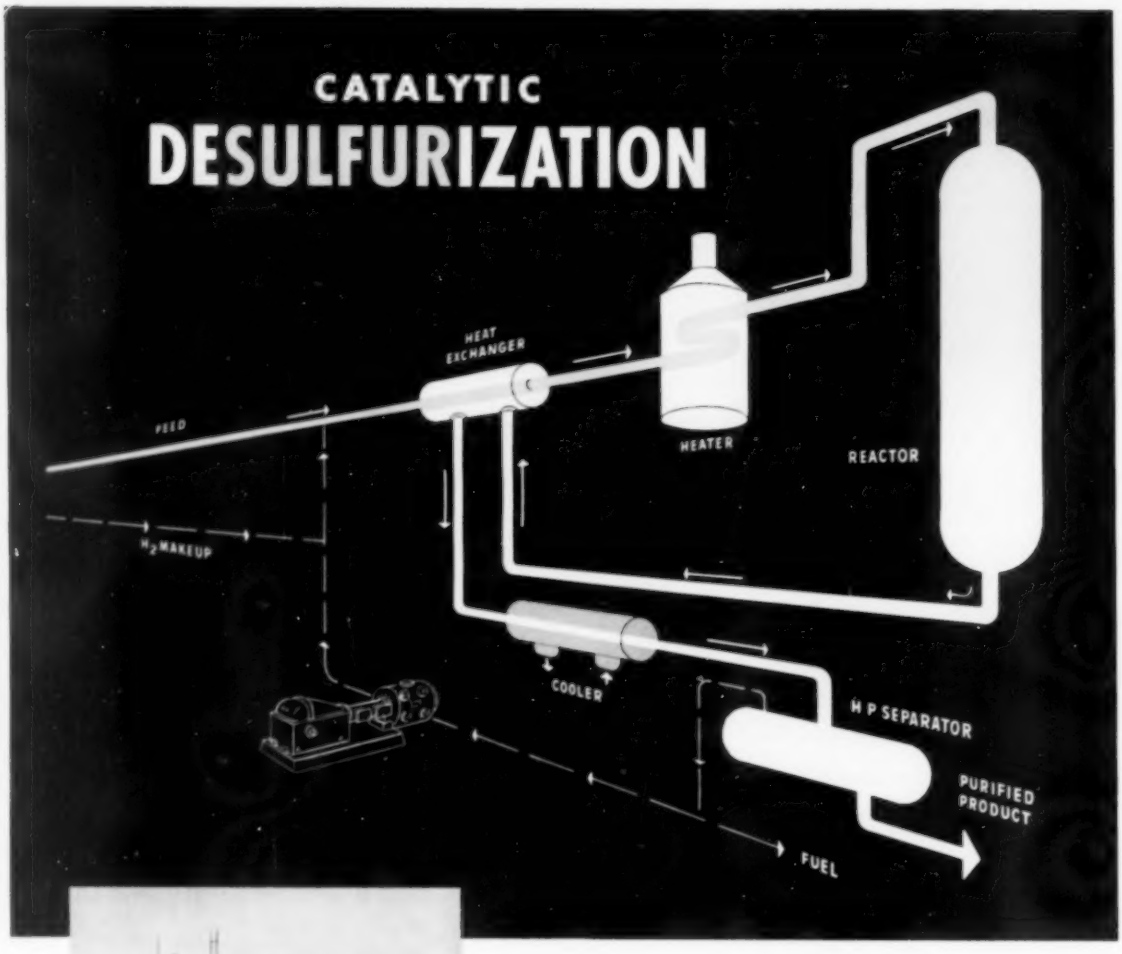

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at low overall cost

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For full technical details of this process, send for the Feb. 1955 issue of "Heat Engineering", Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

FOSTER WHEELER

(To obtain more data on advertised products see page 404)

GIRDLER'S NEW CATALYST PLANT at Louisville, Ky., will be completely outfitted for operations by this April. A $1,000,000 investment, the plant is on a 19-acre tract, where all the company's catalyst manufacturing operations are being consolidated. Here (left to right) Dr. J. E. Taylor and John Cromeans, of the field service staff, check a blueprint with Dr. R. E. Reitmeier, manager of the catalyst dept. In the background a workman adjusts a valve on a Bartlett and Snow calciner.

Fisher Opens Plant in Canada

Fisher Governor Co., Marshalltown, Ia., will begin operations this spring in a factory purchased two years ago at Woodstock, Ont., Canada. Diaphragm motor valves, liquid level controllers and gas regulators will be made there. General manager of the Canadian plant will be William J. Bestmann, who has been in charge of production scheduling at Marshalltown.

Ethyl Plans Two New Units

A gasoline testing laboratory in Houston will be completed by Ethyl Corp. and put into operation later this year. The company presently operates five such testing laboratories throughout the United States. Each year they test more than 15,000 samples from refineries, service stations and other sources to determine the Motor and Research octane numbers, gum content, distillation and other properties.

Ethyl also is planning to put up a new facility in Canada, a plant for the manufacture of antiknock compounds. To be built at Sarnia, Ont., the plant will be owned and operated by Ethyl Corp. of Canada Ltd. According to the company, this will be the first unit to make these compounds in Canada.

Phillips and CEC Sign Agreement

Consolidated Engineering Corp.'s line of continuous plant analysis and control instruments was given a boost recently by the conclusion of an agreement with Phillips Petroleum Co. to manufacture and market instruments developed by Phillips.

Immediate marketing is proposed for the following: infrared gas analyzers, differential refractometers, ultraviolet analyzers, and oxygen analyzers.

Ultrasonics Co. Established

Industrial ultrasonic processing equipment will be manufactured and marketed by General Ultrasonics Co., Hartford, Conn., a new firm under the direction of Alexander S. Keller, president and treasurer, Stanley R. Rich and Dr. Wilfred Roth, vice-presidents, and Saul Seidman, attorney, secretary.

Mr. Keller has been associated with the Keller Mechanical Engineering Corp. of Brooklyn, N.Y., Pratt & Whitney Div. foreign sales, the Economic Cooperation Administration of the government, and has engaged in private management consultation for foreign and domestic clients.

Mr. Rich and Dr. Roth are co-directors of Rich-Roth Laboratories, Hartford. They developed the new company's line of equipment, including the Rich-Roth "400" ultrasonic generator and transducers, which have already been introduced by Rich-Roth Laboratories. This firm will continue its separate identity and activities under their direction.

Pacific Forge Plans New Plant

A $1,000,000 forge plant will be constructed at South Fontana, Calif., by Pacific Forge, Inc., subsidiary of Pacific Valve, Inc. The plant will supply the parent company with valve forgings for the oil industry. J. B. Gill Co., Long Beach, has been awarded the engineering and construction contract.

Kuljian "Engineer of 1954"

Outstanding achievement as a consultant, designer, and construction engineer was recognized in the recent citation of Harry A. Kuljian as "Engineer of 1954" by the Pennsylvania Society of Professional Engineers. Mr. Kuljian is president of the Kuljian Corp., Philadelphia, international engineering and construction firm. The award was made at a luncheon in Mr. Kuljian's honor at the Engineers' Club in Philadelphia.

Mr. Kuljian

Born in a small town in Armenia in 1893, Mr. Kuljian came alone to the United States at the age of 16. He held a number of odd jobs and attended day and night schools to receive his high school diploma, then acquired an engineering degree from M.I.T. Before founding his own firm in 1930 Mr. Kuljian worked with Stone & Webster, Westinghouse, RCA Manufacturing Co., and the American Viscose Co.

Personnel Changes

Babcock & Wilcox Co.—Glen H. Rearick, formerly in charge of the Alliance, Ohio, plant of the Tubular Products Division, has taken charge of the company's plant in Milwaukee, recently purchased from Globe Steel Tubes Co.; W. C. Buchanan, formerly Globe's president, will remain with B&W in an advisory capacity; Sidley O. Evans to newly created position of manager of tubing operations of the Beaver Falls, Pa., plant; Laurence W. Hayward, previously asst. chief engineer of the boiler div. to manager of the newly formed contract and erection dept.

Worthington Corp.—Aloysius M. Tullo, works manager of the Harri-

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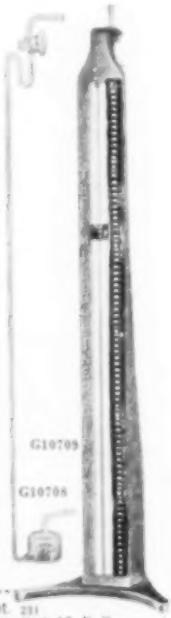
G10709	Range: 0-800 mm. (with Stand)	ea. 79.50



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son, N. J., plant, to general manager of the newly established Harrison div.; Clarence K. Hood to div. sales manager.

Consolidated Engineering Corp.—Jack K. Walker, manager of the analytical instrumentation group, to the systems div. as project chief for process control systems in chemical, petroleum and petrochemical industries.

Research-Cottrell, Inc.—Harry M. Pier, to special asst. to the chairman of the board to conduct new studies in the field of air pollution; Charles E. Beaver succeeds Pier as general sales manager.

H. K. Ferguson Co.—Otto F. Sieder to newly created post of vice-chairman of the board, from president. The presidency has been assumed by Wells N. Thompson, vice-president and eastern district manager; Robert L. Cashen succeeds Thompson, with Norvon Clark as asst. eastern district manager; Robert R. Cutler to vice-president and manager of the central district; C. J. Haglund to vice-president and manager of the western district office; Thomas H. Mitchell and Ralph W. Olmstead to vice-president, the former to assist the president in construction matters, the latter in obtaining new business.

Hooker Electrochemical Co.—James M. Young III, and Robert P. Keating to the process study group; Dr. John T. Rucker, Jr., to administrative asst. to the director of research and development; John A. Fyffe to sales representative with the New York office.

International Nickel Co., Inc. — James B. Morey to head of the Cincinnati, Ohio, technical field section of the development and research division, succeeding C. T. Haller, Jr., who has become head of the Pittsburgh, Pa., technical field section; Howard N. Farmer, Jr., to the West Coast section at Los Angeles; E. A. Tice to the New England section at Hartford, Conn.; William S. Mounce to the division's constructional alloy steel section in New York.

Mechanical Industries, Inc.—James E. Stopford to chief field engineer, with charge of the company's dust and smoke control installations. He was once an engineer with Stanolind Oil & Gas Co. and is a graduate petroleum engineer.

Catalytic Combustion Corp.—Harold R. Suter, co-developer of the

Suter-Ruff patented catalysts, to vice-president of research and development.

George Armistead and Co.—George D. McClelland, formerly with Hunt Oil Co., to the staff where he will be in charge of mechanical engineering activities, with headquarters in Washington, D. C.; Frank R. Grant to the staff where he will work with the Athens, Greece, office.

Robertshaw-Fulton Controls Co.—A. W. Roat to field sales representative of the Fielden Instrument Div., covering northern Ohio and part of northwest Pennsylvania.

Minneapolis-Honeywell Regulator Co.—R. A. Schlegel and J. F. Smith to associate sales managers for the oil and chemical industries for the industrial div., Schlegel in the eastern half of the U. S., Smith in the west.

General Controls Co.—W. K. Walters to regional manager of the Houston branch office; A. E. (Bud) Hess to southwest regional manager, with headquarters in Dallas.

Carbide and Carbon Chemicals Co.—DeFrance Clarke, Jr., to asst. manager of the fine chemicals div.; David S. Alcorn to product manager of the division, responsible for the market development of aryl chemicals.

Calumet & Hecla—Robert M. Fritz to sales representative for Wolverine Tube Div., contacting petrochemical plants and refineries in Oklahoma and north Texas.

Manning, Maxwell & Moore, Inc.—Eugene M. Moore to manager of the newly formed industrial controls div.; Karl W. Peterson to sales manager of the unit, C. Garland Roper to chief engineer.

Blaw-Knox Co.—David K. Tomer to administrative asst. to the company's president. He was formerly with the engineering and construction dept. of the Atlantic Refining Co.

Swartwout Co.—Ernest H. Bellard to vice-president in charge of sales; Paul H. Strehle, Jr., to the new post of regional product manager, where he will give full time to sales and service activities of the Autronic process controls division in the Philadelphia-east central area; Joseph P. Green to director of engineering, a new post which will provide unified supervision of the Autronic control, power plant

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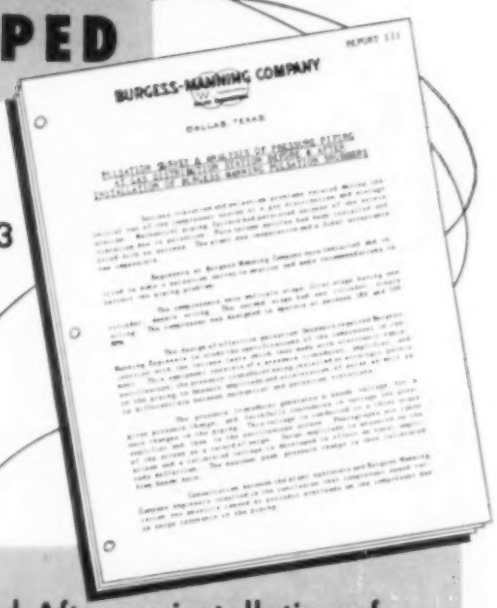

A

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BMM Sound Engineering

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Branches, Distributors

The Fluor Corp. has opened a district sales office at 400 E. & C. Bldg., Denver, Colo., to serve the Rocky Mountain states. Lyman O. Calkins, formerly manager of project coordination for Fluor in Los Angeles, has been appointed district sales manager in charge. William M. Bowles is district sales engineer.

Conoflow Corp. has opened a New York sales-engineering office at 30 Church St. Charles P. Boyd is branch manager, Joseph Bowler sales engineer.

Expansion, Transition

Fielden Instrument Division of Robertshaw-Fulton Controls Co. has expanded its plant and office facilities at 2920 N. Fourth St., Philadelphia, and opened a new engineering and technical service office in St. Louis at 2901-21 Clark Ave. Robert E. Edsall is in charge of the new office.

Clark Bros., a subsidiary of Dresser Industries, Inc., recently became the first of the subsidiaries to move to Dresser's new location at 1354 S. Sheridan Rd., Tulsa, from its old site at 125 W. First St., Tulsa.

Worthington Corp. has moved its Detroit district office from 2824 E. Grand Blvd. to 13305 Puritan Ave.

Vanton Pump & Equipment Corp. has transferred executive and sales offices to its plant location, 201 Sweetland Ave., Hillside, N. J.

Mettler Co. of Los Angeles has been acquired by Eclipse Fuel Engineering Co. Mettler, manufacturers of gas burners and dual fuel burners, will be operated as a division of Eclipse.

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Combustion, Smog, and the Oil Industry

Combustion and Smog, Report No. 2 by W. L. Faith, Sept. 1954, 11 x 8½ in., 63 pages, table of contents, paper back, $3.00, Southern California Air Pollution Foundation, 704 S. Spring St., Los Angeles 14, Calif.

RECENT public demonstrations and political pronouncements in Los Angeles County blamed the petroleum industry for an acute smog attack. The petroleum industry's contention that their direct contribution to Los Angeles smog was actually "small potatoes" went unheard, but now receives support in the second report on *Combustion and Smog* issued by the Southern California Air Pollution Foundation.

The effect of combustion processes on smog was studied by Stanford Research Institute and the Los Angeles County Air Pollution Control District for the year 1953 and reported in the above mentioned publication.

There is fairly good agreement that automobile exhaust hydrocarbon emissions exceeded 1000 tons/day, compared to lesser amounts from fuel oil and natural gas. Combustion of non-natural gas fuels by the petroleum industry contributed only about 398 tons/day to the total of 2665 tons/day. Backyard incinerators alone were responsible for 414 tons/day combustion products to the atmosphere.

Though all are guilty, the greatest responsibility appears to lie with automobile manufacturers and owners. Proposals are being studied to reduce hydrocarbons from automobile exhausts by changes in carburetion, improved combustion in cylinders, exhaust gas treatment, improved maintenance practices and changes in fuel composition.

Report No. 2 on *Combustion and Smog* is comprehensive, but contains contradictory material accumulated from a number of sources. These disagreements serve to emphasize the need for continuing study and research.

The effects of burning fuel oil, fuel gases, gasoline in automobiles, diesel fuel in trucks, and trash in backyard incinerators, etc., are discussed in detail. Conflicting data are compared and evaluated.

Highlights of the report include estimated figures for the amounts of materials burned in 1953, and their individual contributions to the smog and air pollution problem.

Laboratory experiments conducted on crops and plant damage, eye irritation, atmospheric aerosols, and backyard "incinerator" efficiency are also discussed. In all cases some researchers claim to have reproduced the smog mechanisms, while others have failed. Much remains to be learned concerning these subjects.

Hydrocarbon exhaust from automobiles is one of the major contributors to atmospheric pollution, and highly suspect as involved many of the smog's deleterious effects.

Consensus is that automobile fuel compositions have little effect on combustion products due to the high temperatures and pressures in modern automobile engines. However, good maintenance of all cars might reduce hydrocarbon emission as much as 50%. Reduction of stop-and-go driving, with deceleration and idling periods, would be of further benefit.

Increased efficiencies in modern automobile engines will be of little benefits in the reduction of hydrocarbon emissions due to today's "horsepower race" which counteracts the benefits of greater engine efficiency.

Chemical Process Principles Revised

Chemical Process Principles, Part I—Material and Energy Balances, 2nd edition, by Olaf A. Hougen, Kenneth M. Watson, and Roland A. Ragatz, 1954, 9¼ x 6¼ in., 539 pages, indexed, illustrated, stiff cloth cover, $8.50, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y.

IN 1931 Drs. Hougen and Watson, professors of chemical engineering at the University of Wisconsin, authored a college textbook covering stoichiometry, and material and energy balances, *Industrial Chemical Calculations*. This text, revised in 1936, received wide acceptance in beginning chemical engineering classes, and served as the precursor of a more comprehensive three-volume series, *Chemical Process Principles*.

The first volume of the new series covering material and energy balances, was published in 1943. The second volume on thermodynamics and the third on kinetics and catalysis were published in 1947. In 1948 the three volumes were published under a single cover.

The revised second edition of *Chemical Process Principles, Part I*, published in December of 1954, includes the newest applications to industrial problems and other current data made available since the first edition some 12 years ago.

New information is supplied on material balances in stagewise extraction. There are new discussions on equilibria in ternary systems and the thermochemistry of nuclear reactions. Two new chapters on mathematical procedures and adsorption have been added to the subjects covered in the first edition, such as stoichiometric and composition relations, behavior of ideal gases, vapor pressures, humidity and saturation, solubility and crystallization, material balances, thermophysics, thermochemistry, fuels and combustion, and chemical, metallurgical and petroleum processes.

In addition to the original authors—Dr. Hougen who is still at the University of Wisconsin and Dr. Watson who is now vice-president and director of research of the Pure Oil Company laboratories at Crystal Lake, Ill.—Dr. Ragatz, professor of chemical engineering at the University of Wisconsin, has collaborated in the second edition. Dr. Watson has been a past contributor to PETROLEUM PROCESSING, having co-authored the popular reprint series on "Principles of Reactor Design" in 1946.

Recent Books Briefly Noted

Materials for Product Development 1954, Proceedings of the Basic Materials Conference held with the Second Basic Materials Exposition, Chicago, May, 1954, 9¼ x 6¼ in., 159 pp., illustrated, cloth cover, $7.50, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

. . . considers basic problems of materials of the future, new metal forming processes, non-metallic materials, joining, corrosion protection and materials management including such materials as steels, plastics, carbon-graphite, ceramics, glass, adhesive, and heat-resistant coatings with questions and answers at the end of each section.

Government-Owned Inventions Available for License—Metal Processes and Apparatus, Machinery, and Transportation Equipment, Patent Abstract Series No. 4, PB 111467, 10¼ x 8 in., 55 pp., paper cover, $2.00, Office of Technical Services, U.S. Department of Commerce (Room 6227), Washington 25, D.C.

. . . contains abstracts of 657 government owned inventions in the oil and other industries available for licensing to businesses including ferrous and non-ferrous metals and processes, coating processes and

apparatus, construction, mining and oil field equipment, material handling equipment, pumping equipment, etc.

Measuring, Sampling, and Testing Crude Oil, 1st ed., Jan. 1, 1955, API Standard 2500, 10½ x 8 in., 56 pp., illustrated, paper cover, $1.00, American Petroleum Institute, 50 W. 50th St., New York 20, N.Y.

. . . supersedes Part 2: API Code 25, 7th Edition, June 1948, and covers liquid volume and temperature measurement, sampling, gravity and vapor-pressure determination, BS & W, automatic gaging devices, automatic temperature devices, tankships and barges.

Quality Control and Research, 9 x 6 in., 24 pp., paper cover, $0.25, Scientific Apparatus Makers Association, 20 N. Wacker Drive, Chicago 5, Ill.

. . . for the smaller business to insure products in tomorrow's market discusses product specification requirement trends, advantages from the recent federal income tax revision, the cost of establishing a small quality control laboratory, and the introduction of quality control to the company.

Monomolecular Layers, edited by Harry Sobotka, 1954, 9¼ x 6¼ in., 204 pp., illustrated, indexed, cloth cover, $4.25 ($3.75 to AAAS members), American Association for the Advancement of Science.

. . . symposium of nine papers presented on Dec. 27, 1951, at the Philadelphia meeting of the AAAS giving a cross-section of recent progress in monomolecular layers including biochemical application of film techniques, molecular weights of proteins, surface films and detergents, adsorption by radiotracers, properties of films at oil-water interfaces, etc.

Dimensions and Tolerances for Flexible Standard-Wall Polyethylene Pipe, 1954, 9 x 6 in., 8 pp., paper cover, 5 cents, U. S. Department of Commerce, Business and Defense Services Administration, Washington 25, D.C.

. . . establishes dimensions and tolerances for inside diameters and wall thicknesses of 10 nominal sizes of flexible polyethylene pipe from ½-in. to 6-in. diameter, and minimum weights in pounds per 100 feet pipe, with methods of sampling, testing, and labeling pipe in accordance with the Commercial Standard.

Testing of Stainless Steel Weldments, by Helmut Thielsch, Bulletin No. 18, Sept. 1954, 11¼ x 8¼ in., 26 pp., paper cover, $1.00, Welding Research Council of the Engineering Foundation, 29 W. 39th St., New York 18, N.Y.

. . . discusses applicability of visual, magnetic-particle, fluorescent-penetrant, dye-penetrant, radiographic, and ultrasonic inspection and of mechanical, corrosion, specimen, leak, etch, and restrained crack-sensitivity testing with a review of 150 references to published and unpublished information.

Handbook of Ball and Pebble Mill Operation, 32 pp., 11 x 8½ in., illustrated, paper cover, $1.00, Paul O. Abbe, Inc., Center St., Little Falls, N.J.

. . . has chapters on types of mills and linings; principles of grinding; good milling procedures; controls for better grinding; and questionnaires on mill speed, grinding media quantity, type and size, etc., for application to any type of grinding mill.

Symposium on Effect of Temperature on the Brittle Behavior of Metals with Particular Reference to Low Temperature, ASTM Special Technical Publication No. 158, 9 x 6 in., 474 pp., illustrated, cloth cover, $7.50, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . for designers, engineers, metallurgists, and fabricators of chemical equipment and pipelines, etc., includes 27 papers covering evaluation of brittle failures, design criteria of metal behavior, metallurgical and mechanical factors, evaluation of notch toughness tests, and titanium and quenched-and-tempered high-strength steels.

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Research Sessions at API Meeting

THE tentative program has been set for the analytical research sessions of the American Petroleum Institute Division of Refining's 20th midyear meeting. As announced in the February issue of PETROLEUM PROCESSING, the meeting will take place in the Jefferson Hotel, St. Louis, Mo., from May 9 to 12.

The first session on analytical research will be held Monday, May 9, at 9 a.m. Papers to be given are as follows:

"Spectrographic Determination of Traces of Nickel and Vanadium in Petroleum Products by Catalytic Ashing Process," by J. E. McEvoy, T. H. Milliken, and A. L. Juliard, Houdry Process Corp.

"Flame Spectra of 20 Metals Using a Recording Flame Spectrophotometer," by M. Whisman and B. H. Eccleston, U. S. Bureau of Mines.

"Determination of Trace Metals in Oils," by H. G. Schutze, B. N. Hill, A. E. Walters, and J. T. Horeczy, Humble Oil & Refining Co.

"An X-Ray Spectrographic Method for the Determination of Vanadium and Nickel in Residual Fuels and Charging Stocks," by E. N. Davis and Barbara C. Hoeck, Sinclair Research Laboratories.

"Metal Contaminants vs. Catalytic Conversion," by H. W. Cogswell, D. Milsom, and A. R. Rescorla, Cities Service Research and Development Co.

"The Determination of Total Nitrogen in Reformer Charge Stocks," by R. W. King, and W. B. M. Faulconer, Sun Oil Co.

"Determination of Trace Amounts of Basic and Total Nitrogen in Petroleum Distillates," by D. T. Fanale, R. E. Fricioni, D. W. Hutton, R. E. Snyder, and R. O. Clark, Gulf Research and Development Co.

"The Spectrophotometric Determination of Carbonyl Sulfide in Petroleum Refinery Gases," by F. J. O'Hara, W. M. Keeley and H. W. Fleming, The Girdler Corp.

The second session on analytical research will take place the same afternoon and will feature the following papers:

"Analytical Laboratory Operation and Control Utilizing Machine Punched Card Procedure," by L. M. Addison, E. H. Spencer, and E. M. Charlet, Esso Laboratories.

"A New Look at the Composition of Lubricating Oil," by F. W. Melpolder, R. A. Brown, T. A. Washall, W. Doherty, and C. E. Headington, The Atlantic Refining Co.

"A Differential Infrared Method for Quantitatively Determining Specific Hydrocarbons," by O. Easton and C. W. Key, Richfield Oil Corp.

"Determination of Six and Seven Carbon Naphthene in Reformer Charged Stock," by the subcommittee on determination of naphthenic hydrocarbons (COAR), C. C. Martin, S. S. Kurtz, Jr., and collaborators, Sun Oil Co.

"Colorimetric Determination of Low Concentrations of Oxygen in Gases," by G. S. Stafford, J. E. Puckett, and M. D. Grimes, Phillips Petroleum Co.

"Laboratory Methods for the Determination of Evaporation Losses of Petroleum Products," by J. Holowchak, Standard Oil Development Co.

"The Polarographic Determination of Elemental Sulfur in Crude Oil and Petroleum Fractions," by J. F. Miller and W. Hubis, Mellon Institute of Industrial Research; H. V. Drushel and R. O. Clark, Gulf Research and Development Co.

"Analytical Distillation in Miniature Columns. II: Column Performance at Atmospheric Pressure and 300 MM," by A. G. Nerheim and R. A. Dinerstein, Standard Oil Co. (Ind.).

General papers will be read in a session to run concurrently with the first heat transfer symposium on Monday morning. Titles of the general papers are:

"New Method for Obtaining Vapor-Liquid Equilibrium Data," by F. M. Tiller, Lamar State College of Technology, and R. S. Ramalho and M. D. Peterson, Vanderbilt University.

"Forces Acting in Flowing Beds of Solids," by John W. Delaplaine, Cox and Weinrich; and "Design and Development of Sealess Pumps," by D. P. Litzenberg and H. T. White, Chempump Corp.

A second general session is scheduled for Tuesday morning, to run concurrently with the final heat transfer symposium. Heard at that time will be the following papers:

"Modified Law of Corresponding States," by Oscar T. Bloomer, Eastman Kodak Co. and R. E. Peck, Illinois Institute of Gas Technology.

"The Continuous Catalytic Hydrochlorination of Styrene," by R. S. Montgomery, Dow Chemical Co.

"Flow of Non-Newtonian Fluids—Correlation for the Laminar, Transition and Turbulent Flow Regions," by A. B. Metzner and J. C. Reed, University of Delaware.

"Recovery of Ethylene Glycol from Spent Anti-Freeze Solutions," by M. B. Glazer and George Thodos, Northwestern Technological Institute.

X-Ray Diffraction School To Hold 20th Session

The 20th session of the Norelco X-ray Diffraction School will be held at the plant of the North American Phillips Co., 750 S. Fulton Ave., Mt. Vernon, N. Y., during the week of April 4 to 8.

Basic subjects covered by the "teachers," who are educators and scientists, include X-ray diffraction, diffractometry and spectrography. There also will be some discussion of new high and low-temperature camera techniques, electron microscopy and electron diffraction.

Louisville Made Site of AIChE National Meeting

A solvent extraction symposium and three heat transfer symposia will figure on the program of the American Institute of Chemical Engineers' Louisville, Ky., national meeting. Scheduled for March 20 to 23, the meeting will be held in Louisville's Kentucky Hotel.

The symposium on solvent extraction will take place on Monday afternoon, March 21. Titles of some of the papers to be heard follow:

"Studies in the Rate of Fall of Liquid Droplets," by William Licht and G. R. S. Narasimhamurty, University of Cincinnati.

"Prediction of Ideal Stage Requirements in Complex Liquid-Liquid Extraction Systems," by H. C. Peterson and G. H. Beyer, Iowa State College.

"Operating Characteristics of the Pump-Mix, Mixer Settler," J. H. Holmes and A. C. Schafer, Jr., General Electric Co.

"Phenol Extraction from Industrial Wastes with the Rotating Disc Contactor (RDC)," by David C. McLean, Turbo-Mixer Division, J. R. Spraul, and J. Crowl, General American Transportation Corp.

Heat transfer sessions will be featured on Monday morning and afternoon and on Tuesday morning.

Metals Congress to Discuss New Metals in Petroleum

The American Society for Metals will feature a session on "New Metals in the Petroleum Industry" at the Ninth Western Metal Congress, to be held at the Ambassador Hotel, Los Angeles, from March 28 to April 1.

The session will have a panel format, with Dr. Claude Clarke, metallurgical engineer, Timken Roller Bearing Co., as the chairman. Among the panelists will be George Nelson, a research metallurgist with Shell Oil Co., who will speak on "Corrosion and Embrittlement of Metals for High-Pressure Processing." Also, Alexander P. Maradudin, materials engineer and metallurgist with Standard Oil Co. of California, will discuss "Metals in High-Temperature Applications in the Oil Industry."

Oil Man's Calendar

MARCH

American Institute of Chemical Engineers, Kentucky Hotel, Louisville, Ky., Mar. 20-23.

Western Petroleum Refiners Assn., 43rd annual meeting, Plaza Hotel, San Antonio, Texas, March 28-30.

Ninth Western Metal Congress and Exposition, American Society for Metals and others, Pan American Auditorium, Los Angeles, Mar. 28-Apr. 1.

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

BUBBLE CAPS and risers, made of various metals, catalog 54; Pressed Steel Co. See adv't. p. 436.

CALCIUM ACETATE, for processing, data sheet and samples; Baker and Adamson, Gen'l. Chemical Div. See adv't. 3rd cover.

CLEANING COMPOUND, for heat exchangers and condensers, handbook; Oakite Products, Inc. See adv't. p. 412.

COMBUSTION UNITS, for vertically fired heaters, folder 498; National Airoil Burner Co., Inc. See adv't. p. 424.

FLANGES, drop forged, wide range of sizes and styles, brochure; Phoenix Mfg. Co. See adv't. p. 400.

FLOATING ROOFS, double pontoon, manual WP-14; Gen'l. American Transportation Corp. See adv't. p. 300.

FLOOR MAINTENANCE, polishers and scrubbers, information; Lincoln-Schlueter Floor Mach. Co. See adv't. p. 428.

FRANGIBLE DISCS, for pressure protection, data sheet file; Frangible Discs, Inc. See adv't. p. 400.

FUELS, premium, performance and behavior report, booklet; The Ethyl Corp. See adv't. pp. 370-371.

HEAT ENCLOSURES, booklet describes method of fabrication; M. H. Detrick Co. See adv't. p. 382.

HEAT EXCHANGERS, shell and tube types, bulletin HT-654; National Radiator Co. See adv't. p. 332.

JACKETED PIPE, for uniform temperature and batching problems, bulletins J-50 and F1-49; Hetherington & Berner, Inc. See adv't. p. 397.

LIQUID DENSITY, measurement and control, "Densitrol," bulletin W-3; Precision Thermometer & Instrument Co. See adv't. p. 412.

MANOMETERS, absolute and differential, manual on request; The Emil Greiner Co. See adv't. p. 396.

MECHANICAL SEAL, for pumps, "Teflon," bulletin MS-954; U. S. Gasket Co. See adv't. p. 410.

MIXERS, side and top entering, 8 catalogs and data sheets; Mixing Equipment Co. See adv't. p. 342.

NATURAL GAS, booklet available on Government regulation; Natural Gas and Oil Resources Comm. See adv't. pp. 322-323.

PIPING, steam-traced, aluminum, data available; Aluminum Co. of America. See adv't. p. 309.

PLANT DESIGN and construction, brochure 103; Kaiser Engineers. See adv't. p. 413.

PRESSURE SWITCH, for explosive atmospheres, data sheets 920-25; Barksdale Valves. See adv't. p. 390.

PRESSURE TRANSMITTER, electrical, bonded strain gage, literature; Taber Instrument Co. See adv't. p. 384.

PULSATION SNUBBERS and vibration dampeners, report number 3; Burgess-Manning Co. See adv't. p. 398.

PUMPS, stuffingboxless, many types, bulletin 107; Bingham Pump Co. See adv't. pp. 324-325.

REDUCING ELBOWS, welding type, catalog 54; Midwest Piping Co., Inc. See adv't. p. 434.

REFRACTORY LINING, hydraulic setting, for gun or slap-trowel, brochure RC-28A; Johns-Manville Co. See adv't. p. 416.

STAINLESS STEEL, for refinery applications, booklet; U. S. Steel Corp. See adv't. p. 409.

TANKS, storage, for chemicals, glassed steel, bulletin 918; The Pfaudler Co. See adv't. p. 374.

TUBE EXPANDERS, for rolling and flaring, bulletin; Gustav Wiedeke Co. See adv't. p. 426.

TUBE FITTINGS, "Swagelok," from metal or plastic, catalog; Crawford Fitting Co. See adv't. p. 389.

TUBES, condenser, fabricated from various alloys, publication B-2; Anaconda Copper Mining Co. See adv't. p. 319.

TRAPS, natural gas, heavy duty, catalog 953; W. H. Nicholson Co. See adv't. p. 426.

TRAPS, steam, impulse type, steam trap selector; Yarnall-Waring Co. See adv't. p. 318.

VALVES, lubricated plug, catalog; Homestead Valve Mfg. Co. See adv't. p. 420.

VALVES, various sizes and types, catalog; Crane Co. See adv't. p. 372.

VALVES, plug, catalog available; Wedgeplug Valve Co. See adv't. p. 320.

Meetings

American Power Conference, Sherman Hotel, Chicago, Mar. 30-Apr. 1.

APRIL

First West Coast conference on applied industrial uses of atomic energy, Mark Hopkins Hotel, San Francisco, Apr. 4-5.

X-Ray Diffraction School, sponsored by North American Phillips Co. at company's plant in Mt. Vernon, N. Y., Apr. 4-8.

Corrosion control short course, sponsored by the University of Oklahoma and National Assn. of Corrosion Engineers, Central Oklahoma Section at University of Oklahoma Extension Study Center, Norman, Okla., Apr. 5-7.

National Petroleum Assn., semiannual meeting, Cleveland Hotel, Cleveland, Apr. 13-15.

Natural Gasoline Assn. of America, annual convention, Baker and Adolphus Hotels, Dallas, Texas, Apr. 13-15.

American Society of Lubrication Engineers, annual meeting, Hotel Sherman, Chicago, Apr. 13-15.

Third National Air Pollution Symposium, sponsored by the Stanford Research Institute and others, Huntington-Sheraton Hotel, Pasadena, Calif., Apr. 18-19.

American Society of Mechanical Engineers, spring meeting, Lord Baltimore Hotel, Baltimore, Apr. 18-20.

American Society of Mechanical Engineers, Region VIII Engineering Conference, Rice Hotel, Houston, Apr. 24-27.

MAY

American Institute of Chemical Engineers, national meeting, Shamrock Hotel, Houston, May 1-4.

Liquefied Petroleum Gas Assn., annual meeting, Conrad Hilton Hotel, Chicago, May 1-4.

American Petroleum Institute, meetings of evaporation loss committee and subcommittee, Edgewater Beach Hotel, Chicago, May 2-4.

American Petroleum Institute, Division of Refining, midyear meeting, Jefferson Hotel, St. Louis, May 9-12.

10th Annual Symposium on Applied Spectroscopy, Hotel New Yorker, New York, May 12-13.

Sixth Latin American Congress of Chemistry, Caracas, Venezuela, May 12-19.

World Wide Chemical Plant and Equipment Exposition and Congress, Frankfurt, Germany, May 14-22.

Chemical Institute of Canada, annual conference, Quebec City, Que., May 30-June 1.

Third Basic Materials Exposition, Convention Hall, Philadelphia, May 31 to June 3.

JUNE

Canadian Gas Assn., annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., June 5-9.

Fourth World Petroleum Congress, Rome, Italy, June 6-15.

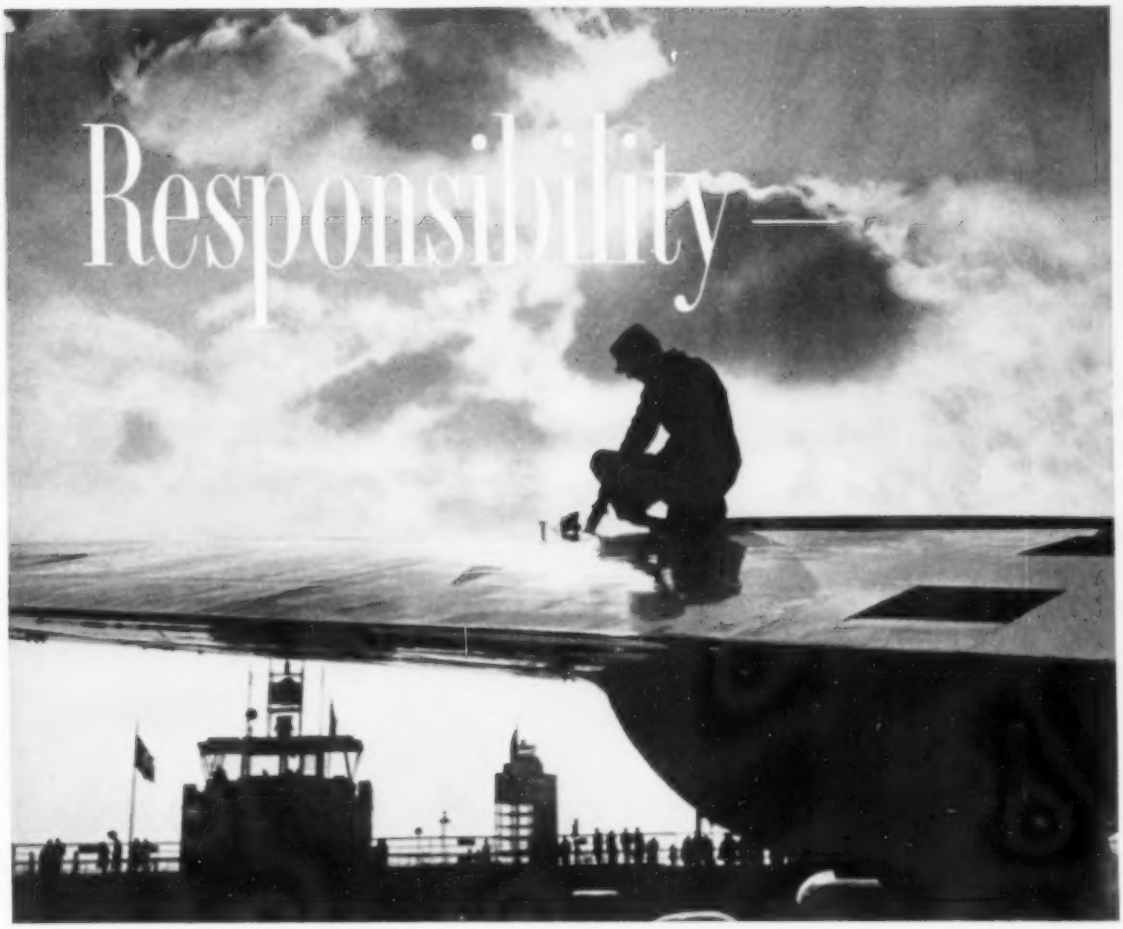
Society of Automotive Engineers, golden anniversary summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 12-17.

American Society of Mechanical Engineers, semiannual meeting, Statler Hotel, Boston, June 20-23.

American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City, N. J., June 28-July 1.

SEPTEMBER

Petroleum Industry Conference, sponsored by the American Institute of Electical Engineers, Houston, Texas, Sept. 27-29.



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(To obtain more data on advertised products see page 404)

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FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products, or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

•

Circle the code letter on the "advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

SAVE TIME • SAVE EFFORT • KEEP INFORMED

USE THIS CARD . . .

to secure information on products and services advertised in *Petroleum Processing* or reviewed in its "*What's New*" section.

FOR ADVERTISED PRODUCT INFORMATION:
Check the Advertiser's Index for advertisement's code letter. Then circle the corresponding code letter on the card below.

FOR "WHAT'S NEW" PRODUCT INFORMATION:
Circle the code number on the card below which corresponds to the number listed at the end of that specific "What's New" item.

THEN:
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PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER JUNE 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
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ADVERTISED PRODUCTS

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A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

3/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER JUNE 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
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ADVERTISED PRODUCTS

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A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
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A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

3/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

FOR MORE INFORMATION...

about products and services advertised in this issue of Petroleum Processing or reviewed in its "What's New" section, use the postage-free cards provided below.
(See other side for complete instructions.)

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary if Mailed in the United States

4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary if Mailed in the United States

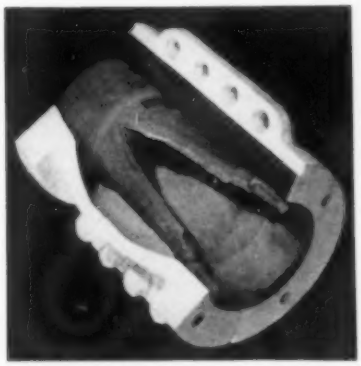
4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

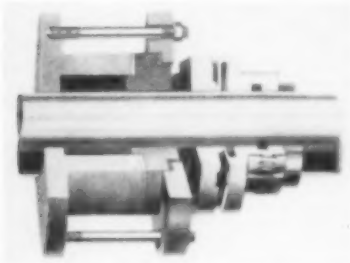
WHAT'S NEW...



New Control Valve Handles Solids in Suspension

. . . acid slurries or other bulky materials. The "Red Jacket Valve" can be operated either pneumatically or hydraulically for on-off service or as a control valve. Construction is of a cast iron body inside of which is a sleeve of pure gum rubber, butyl, or neoprene. Air or hydraulic pressure in the annular space between the sleeve and body compresses the sleeve, constricting the flow of material through the sleeve. The impulse from the controlling instrument or solenoid valve can be put directly into the valve body. Cast iron bodies are satisfactory for operation up to 150 psig, and steel bodies are available for pressures of 600 psig and higher. The pure gum rubber sleeves are reinforced with multi-ply cords and will withstand temperatures of 180° F. Different sleeve materials are available for high temperatures and pressures. Standard valve sizes are 1 in. to 24 in. with sizes from 30 in. to 72 in. also available. Red Jacket Co., Inc., Investment Bldg., Pittsburgh 22, Pa.

Circle No. **1** *on Reply Card*



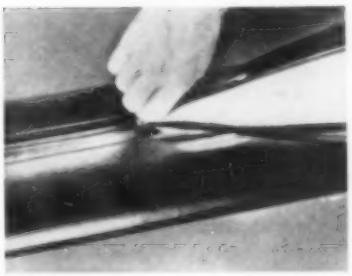
External Mechanical Seal Has Teflon Bellows

. . . for chemical inertness to acids, alcohols, alkalies, hydrocarbons and abrasive and tarry materials. The seal is of the external type for pumps, and agitator shafts, and rotates with the shaft. The only bearing surface is between precision ground rotating and stationary faces. Low friction load on the shaft requires low starting torque and power cost. Shafts using the seal do not score, and shafts already scored by other seals or packing can be satisfactorily sealed. The "Chemiseal Mechanical Seal" is available in standard sizes from 7/8-in. to 2 3/8-in. with other sizes available. United States Gasket Co., Camden 1, N. J.

Circle No. **2** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.



Plastic "Zipper" Cover Protects Pipe and Duct Insulation

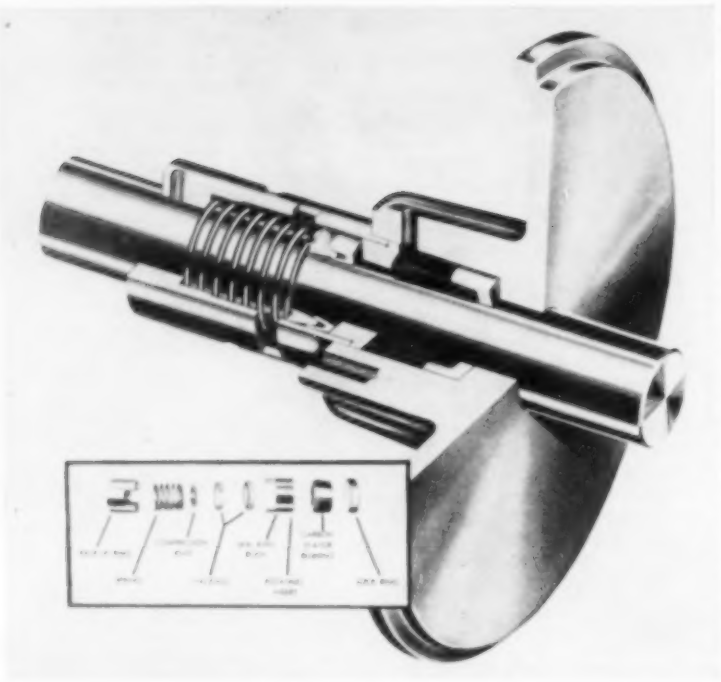
. . . from weather, abrasion, moisture, and most chemicals. "Protektinsul" covers are made of Krene plastic—a Bakelite Co. product—which resists moisture-vapor transmission, mold, and mildew, and is flexible and durable. The cover is simply wrapped around the insulated pipe or duct and closed by pulling a slide fastener which locks the pre-formed edges together holding the cover in place and completing the seal around the pipe. End joints or fittings are wrapped with Krene tape. A Bakelite vinyl resin based coating is brushed on to seal the fitting cover. The cover provides ready access to the pipe at any point without damage to the cover. It can be used on insulated pipe indoors or outdoors, underground in a steam-distribution system of conduits or on low-pressure building heat supply lines. High dielectric strength and electrical insulation properties protect pipes against electrolytic corrosion due to galvanic action or stray current effects. Available in black or colors to cover insulated pipe from ½ to 33 in. diameter, it comes in lengths up to 100 ft. Miracle Adhesives Corp., 214 E. 53rd St., New York 22, N. Y.

Circle No. **3** *on Reply Card*

Low Cost Pneumatic Controller Has Narrow Band Control

. . . for use on simple industrial processes and provides sharp on-off or narrow band proportional control of such variables as temperature, pressure, liquid level and humidity. Equipped for on-off action, the controller snaps the control valve from fully open to fully closed with negligible lag when the measurement crosses the control point. For a process requiring throttling action the "Model 41A" is equipped with a proportional unit adjustable from ¼ of 1% up to 25% of scale, which is a simplified blast feedback proportioning mechanism relying on an air jet rather than bellows actuated "follow-up" action. The Foxboro Co., Foxboro, Mass.

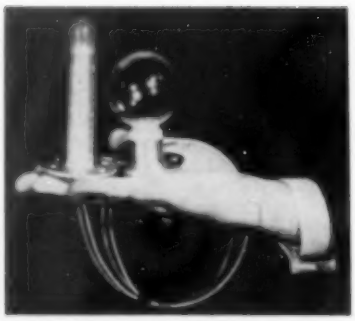
Circle No. **4** *on Reply Card*



Mechanical Seals Installed Quickly

The "Chempro Wedge-Lock" has complete interchangeability with stuffing-box packing in pumps, agitators, autoclaves, and other rotating processesing equipment. It requires no special holding clamps, and no machining of stuffing-box faces to assure alignment. The seals have been used successfully for acids, caustics, solvents, other chemical liquids, and slurries that previously could not be sealed mechanically. The sealing faces are located inside the stuffing-box, reducing hazards in handling corrosive, toxic, explosive, and flammable liquids. Design is simple, consisting of eight parts. Installation and servicing can be handled in the field without special personnel. Chemical and Power Products, Inc., 11 Broadway, New York 4, N. Y.

Circle No. **5** *on Reply Card*



Explosion Extinguisher Is Electronically Controlled

. . . with the response of the system not dependent on flame contact, pressure rise, or temperature rise. In operation the infrared-sensitive photoconductive cell detects infrared radiation—present in all fires and explosions—changing the cell resistance at a speed approaching that of light. The cell change initiates a small detonating charge which bursts a plastic container of fire extinguisher fluid. Sensitivity can be adjusted so as to ignore a match at two or three inches. The "Fireye" does not have to "see" the fire directly, as infrared is more reflective than visible light. Previously in use by the government for military aircraft, it has now been released for commercial production with anticipated applications in ground fuel storage tanks, pumping stations, and similar areas where explosions are possible hazards. Fireye Div., Electronics Corp. of America, 77 Broadway, Cambridge 42, Mass.

Circle No. **6** *on Reply Card*

Aluminum-Coated Steel Is Corrosion-Resistant, Strong

. . . combining the heat reflecting qualities of aluminum with the strength of steel. Called "Aluminized Steel—Type 2", it is made by applying molten aluminum to cold rolled sheet steel by a continuous pre-treatment and immersion process. Said to be superior to zinc coatings with a resistance to atmospheric exposure and reflectivity of radiant heat the same as that of solid aluminum, its resistance to fire damage is asserted to be better than that of aluminum or galvanized steel. Temperatures up to 900° F. do not affect the coating, and 1250° F. does no serious damage. Severe forming operations may be used without peeling or flaking of the coating, but drawing operations are not recommended. Welding is done by conventional methods. It is claimed that the aluminum-coated steel does not require painting to extend its service life, and that the cost will be less than galvanized steel plus one field coat of paint. Product Information Service, Armco Steel Corp., Middletown, Ohio.

Circle No. **7** *on Reply Card*

Small Sized Thermocouple Heads Are Corrosion-Resistant

. . . and light weight, weighing only 3½ oz. Cadmium plating inside and chrome plating outside insures corrosion resistance. The head is easy to assemble by loosening—not removing—the set-screws, and will accommodate wire from 30 to 14 gage. Maximum operating temperature is 200° F, and the size is 2$\frac{5}{32}$ in. long by 1⅛ in. diameter. Conax Corp., 4515 Main St., Buffalo 21, N. Y.

Circle No. **8** *on Reply Card*

DESIGN
ENGINEERING
PROCUREMENT
CONSTRUCTION

It's a complex skill, this business of seeing in a blue print the finished project . . . of visualizing the operation of a processing plant from a maze of lines and symbols on a sheet of paper . . . or translating an algebraic equation into the production capacity of a chemical plant.

Yet here at Procon it's all in a day's work. It has to be, for Procon engineers are entrusted with the creating and building of many different types of processing plants. You'll find these men at home in every phase of process construction . . . at the drawing board . . . around the conference table or on the job site. They are typical of the men who are Procon . . . who have been responsible for the recognition which this organization has achieved among leaders of industry.

PROCON *Incorporated*

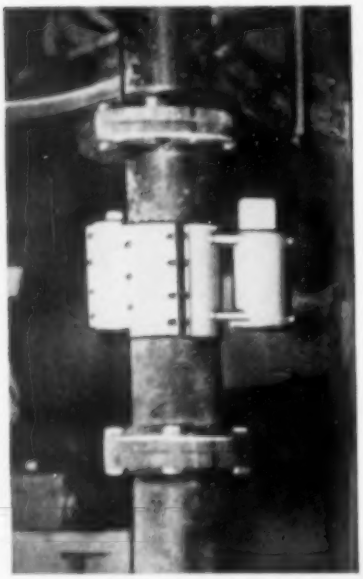
PROCESS CONSTRUCTION

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U. S. A.

AFFILIATED COMPANIES:

PROCON (CANADA) LIMITED—40 ADVANCE ROAD, TORONTO 18, ONTARIO

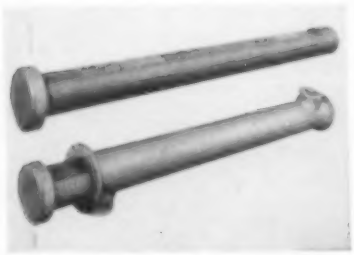
PROCON (GREAT BRITAIN) LIMITED—112 STRAND, LONDON, W. C. 2



Radioactive Density Gage for Slurry Is Mounted Externally

. . . on pipes or vessels containing the material to be measured. Operation is on the principle of radioactive absorption through the slurry. Recommended for agglomerates or abrasives which would interfere with the operation of an ordinary gage, measurements in the range of 0 to 40% solids can be made with a precision of ± 0.3% of solids, in the range of 40 to 80% precision is ± 0.2%, and precision is ± 0.1% for more than 80% solids. The Omart Corp., P. O. Box 67, Sta. B, Cincinnati 22, Ohio.

Circle No. **9** *on Reply Card*



New Graphite Heat Exchanger Withstands Higher Pressure

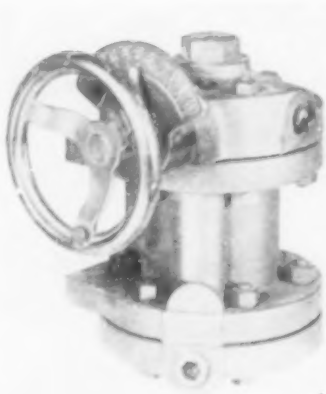
. . . resists severe mechanical shock, is corrosion-resistant and provides for rapid shell side cleaning. Called the "Impervite Cross-Bore" exchanger, it utilizes a solid bar of impervious graphite measuring the total bundle diameter which is drilled longitudinally and laterally. This design supports the bundle from mechanical shock such as steam-hammer. Operating pressure of the exchanger is in the 150 to 200 psi range, previously not economically possible with impervious graphite. The bundle is made from graphite which is extruded, machined, and then impregnated with special resins. It is immune to the attack of all corrosives except a few highly oxidizing agents, has a high rate of thermal conductivity, and will withstand temperatures up to 340° F. The use of "Graph-I-Tite" carbon impregnated graphite allows operation up to 5700° F. The exchangers can be used for heating or cooling, and are furnished with shells of impervious graphite, special alloys, copper aluminum, or can be rubber or lead lined. Falls Industries, Inc., 31837 Aurora Road, Solon, Ohio.

Circle No. **10** *on Reply Card*

30-Channel Recorder Writes On Paper Electrically

. . . eliminating the need for pens, inks and marking devices. Light weight and portable, it can monitor any operation where information can be picked up from a motion controlled switch or a sensing device which can provide current for the marking power. Main feature of the "Alden 30-Channel Fact Finder" is a new paper called "Alfax" which uses electric current in a stylus to mark the paper. Interpretative remarks may be written on the paper by a stylus pencil. The only mechanisms in the unit are for feeding the paper and moving the styli. All elements are of plug-in unit construction. Two models are available, Type #230A-6 with paper speeds of one and six in./min. and Type #230A-12 with paper speeds of one and twelve in./min. Alden Electronic and Impulse Recording Equipment Co., Westboro, Mass.

Circle No. **11** *on Reply Card*

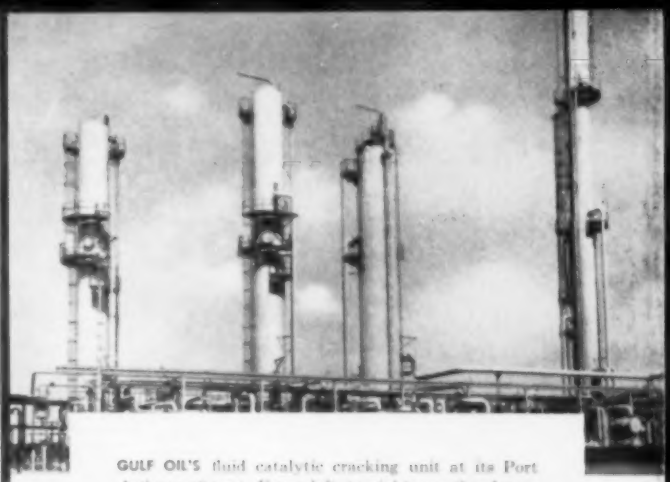


Constant Flow Valve Maintains Rate Within One Per Cent

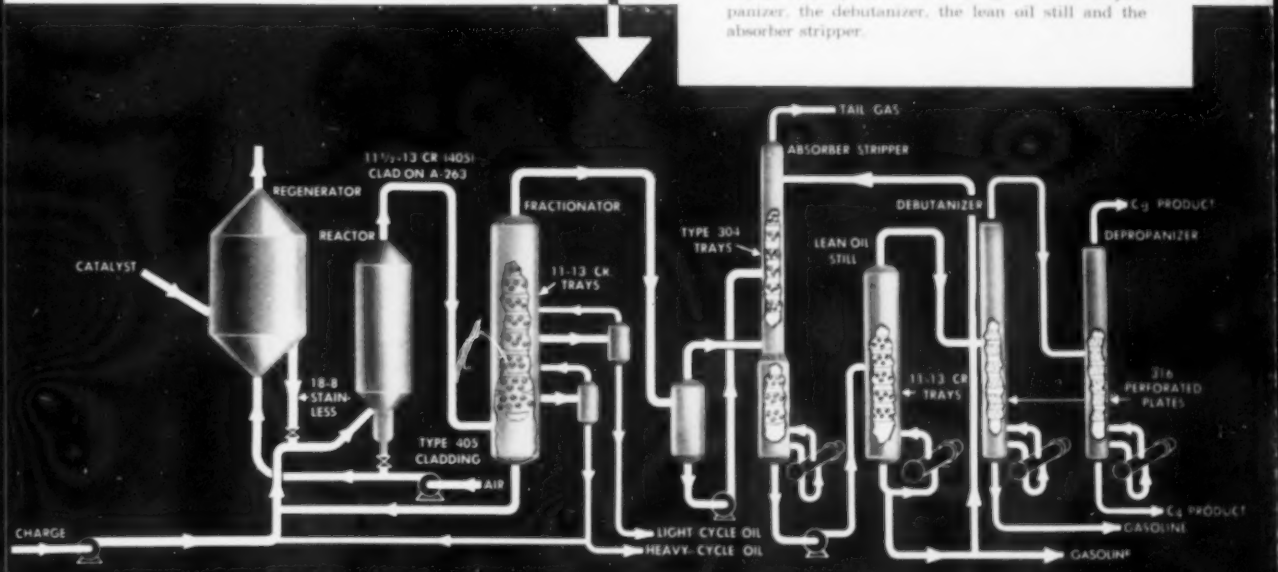
. . . for fuel oil or any other non-abrasive fluid up to 200, 300, 400, 500, 600, or 700 gph as desired. Each model will maintain flow rates as low as 10% of maximum, and are suitable for viscosities as high as 250 SSU at operating temperatures, static pressures as great as 500 psi, and temperatures as high as 250° F. despite fluctuations in upstream or downstream pressure. Flow level may be set manually at the valve or through any one of four optional remote adjusting systems, one hydraulic, one pneumatic, and two electric which may in turn be operated manually or by a pneumatic or electric signal proportional to temperature, flow of another fluid or gas, or other variables. These adjusting systems may use a feedback potentiometer to develop a voltage proportional to flow through the valve. Applications include manual regulation of flow, automatic regulation of flow according to some other process variable, proportioning several flows, etc. Operation is by measurement of pressure drop across an adjustable orifice, the pressure differential applying to a spring-biased hydraulic cylinder connected to operate a throttling valve upstream from the orifice. If the pressure drop across the orifice does not balance the constant force applied by the spring, the resultant piston action causes the throttling valve to re-adjust differential pressure at the orifice to the desired value, and therefore the flow to the preset rate. Askania Regulator Co., 240 E. Ontario St., Chicago 11, Ill.

Circle No. **12** *on Reply Card*

HOW GULF USES STAINLESS STEEL in a fluid catalytic cracking unit



GULF OIL'S fluid catalytic cracking unit at its Port Arthur refinery. From left to right are the depropanizer, the debutanizer, the lean oil still and the absorber stripper.



THE fluid catalytic cracking unit diagrammed here was built in 1951 for the Gulf Oil Corporation's Port Arthur, Tex., refinery. With the help of Stainless Steel—used extensively in trays and piping—this unit handles 65,000 barrels of prepared charging stock daily.

The flow chart shows the various grades of Stainless used in different parts of the unit. Trays in the absorber stripper are Type 304 Stainless Steel, while tray plates in the debutanizer and in the depropanizer are Type 316.

Such careful selection of grades is extremely important in obtaining the maximum corrosion resistance and long life from Stainless Steel. Properly applied, Stainless Steel is one of the most important tools you can use in keeping your refinery operations on stream at all times.

Our new book, "Performance of Stainless Steels in Petroleum Refinery Service," contains much valuable data on properties of various grades. If you do not have a copy, mail the coupon below. And our representatives are always available to assist you in the selection of the right grade of perfected, service-tested USS Stainless Steel.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · USS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

UNITED STATES STEEL

4-683

United States Steel Corporation
525 William Penn Place, Room 4657
Pittsburgh 30, Pa.

Please send me my copy of "Performance of Stainless Steel in Petroleum Refinery Service."

Name .....

Title .....

Company .....

Address .....

City ..... State .....

Performing Seal!

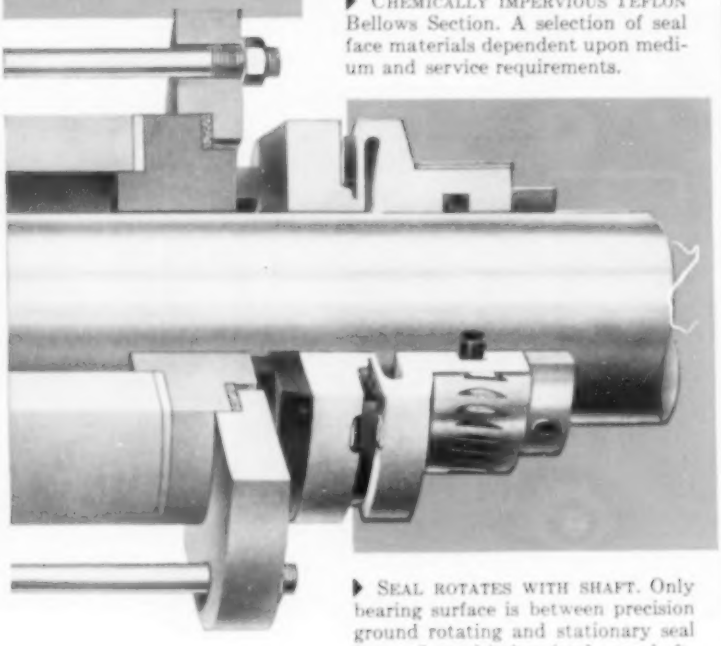
Service that no other Mechanical Seal can match

Pump difficult chemicals...with drop-tight service over longer periods of time. That is what Chemiseal's chemically impervious TEFLON, pressure-balanced bellows design offers you.

The ideal Mechanical Seal that has no equal in handling acids, alkalies, solvents, hydrocarbons, alcohols—clear liquids, slurries and tarry materials.

FEATURES

▶ CHEMICALLY IMPERVIOUS TEFLON Bellows Section. A selection of seal face materials dependent upon medium and service requirements.



▶ SEAL ROTATES WITH SHAFT. Only bearing surface is between precision ground rotating and stationary seal faces. Low friction load on shaft. Lower power cost. Drop tight service.

▶ NO SCORING OF SHAFTS and Chemiseals work satisfactorily on shafts previously scored by other seals or packing.

▶ PRESSURES at the seal up to 100 psi at 75°C or 75 psi at 100°C.

▶ SIZES from ⅞" to 2⅝". Other sizes for special applications.

▶ MAXIMUM LENGTH, all seals 2¾".

Write for Bulletin No. MS-954.

made of du Pont TEFLON

UNITED STATES GASKET COMPANY, CAMDEN 1, NEW JERSEY

USG

FABRICATORS OF FLUOROCARBONS & OTHER PLASTICS

Representatives in principal cities throughout the world

Automatic Data Logger Aids In Continuous Process Control

. . . for the numerical recording of pressure, temperature, flow, weight, stress, level, and other process measurements onto individual vertical columns on the log sheet. A tape with identification digits for each variable is punched simultaneously with the typed log, providing data in a form convenient for further computations. Readout may be hourly, half-hourly, or at other preset intervals. The "Automatic Logger" samples the measured variable continuously and stores the information to be logged at the subsequent readout period. Readout may be the accumulated total of the variable, or the average over a time cycle. Mechanical or electrical "memories" are provided so that the variables are measured at the same interval of time, though the typing of the data occurs sequentially over an extended period. Constant monitoring of variables between readouts allows the logger to print readings of abnormal conditions at any time independent of the regular readout schedule. A readout cycle may be initiated manually by actuating a push button. Analog computer techniques are used to reduce the data to its most suitable form prior to digital presentation. The complete readout system includes the automatic typewriter, tape punch, tabulating card punch, teletype distributor and magnetic tape recorders

In 1954, TRECO completed refinery UNITS for the well-known firms whose signatures are shown above. Every one of these was completed in the time specified.

TRECO's reputation for excellence of process design, quality engineering and fast and reliable construction is your assurance of saving money on your next job. Whether it is a completely new refinery or the revamping of your present facilities, it will be worth your while to contact TRECO during the planning stage.

TELEPHONE, WIRE OR WRITE

TRECO
REFINERY ENGINEERING *Company*
TULSA **TORONTO**

(To obtain more data on advertised products see page 404)

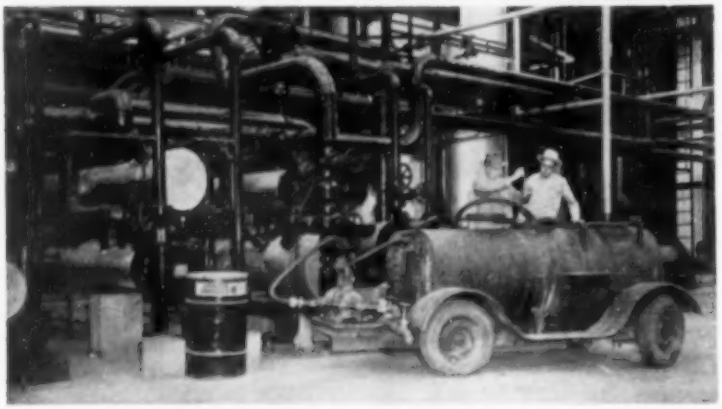
MEASURE, CONTROL LIQUID DENSITY
continuously and automatically with the

Princo Densitrol

PRINCO

Process industries will welcome the new DENSITROL—the precision instrument that gives a continuous reading of density in flowing liquids such as sugar syrups, brine, acids. DENSITROL electrical indicators or recorders can be located remote from the sampling chamber itself. If desired, DENSITROL can be linked with control mechanisms for automatic regulation. For information on temperature and pressure ranges, calibrations, and other specifics, request Bulletin W-3.

PRECISION THERMOMETER & INSTRUMENT CO.
1434 Brandywine Street, Philadelphia 30, Pa.



How refiner saved $1800 cleaning heat exchangers and condensers

Oakite Compound No. 32 soaks scale off tubes— no pulling of bundles

This Oklahoma refinery used a lot of man-power during turnarounds—pulling exchanger bundles for cleaning, and replacing with spares. Then they called in Oakite.

The Oakite Man knew that in-place cleaning was both practical and fast. So, using a portable tank and pump, he circulated a solution of Oakite Compound No. 32 through two exchangers and two condensers.

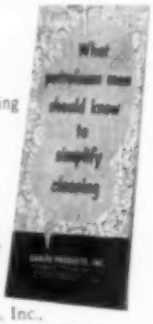
Results: Tubes clean, no attack on metal. Estimated cost of pulling and replacing bundles—$2000. Cost of Oakite materials and method—$160. Saving: $1840.

Proving that—in industrial cleaning it always pays to consult Oakite.

Call your Oakite Technical Service Representative. His experience is yours to draw on. He'll study your cleaning problem, suggest and demonstrate the best material and method. He'll keep checking back to see that you get top quality cleaning at low cost. Call him today!

FREE HANDBOOK—
full of facts on

- Drum reconditioning
- Descaling
- Cleaning tanks
- Salvage cleaning
- Paint stripping
- Cleaning tank car interiors

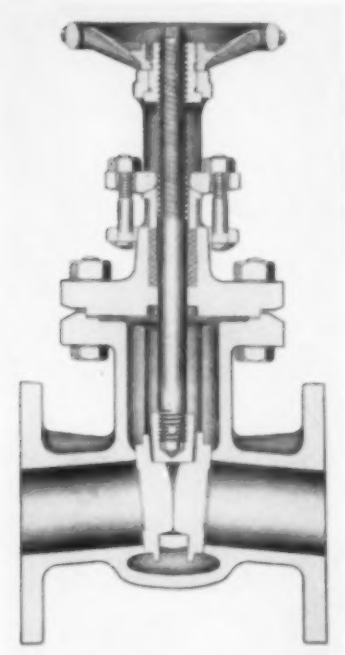


Write Oakite Products, Inc.,
50D Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE petroleum service division
Technical Service · MATERIALS · METHODS · SERVICE · Representatives in Principal Cities of U. S. and Canada

in a 2½ ft. x 4¼ ft. x 8 ft. vertical cabinet shown above and desk type console not shown. The standard logger provides contacts for the operation of external equipment such as a card punch. Overall accuracy for data recorded from electrical imputs is ±0.15%, and recorded from pneumatic inputs is ±0.25%. Fischer & Porter Co., 299 Jacksonville Road, Hatboro, Pa.

Circle No. **13** *on Reply Card*

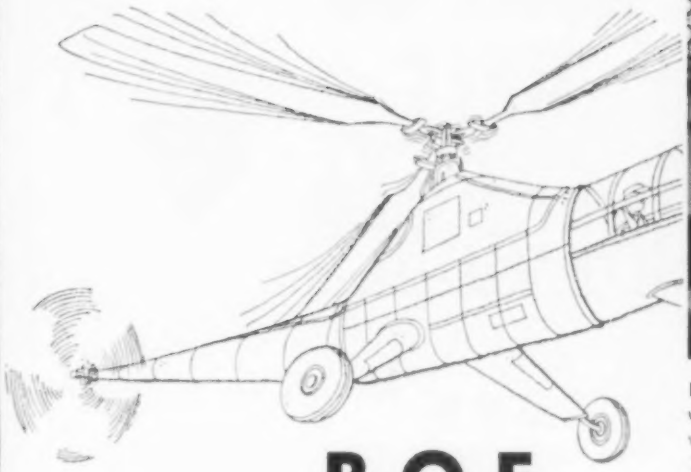


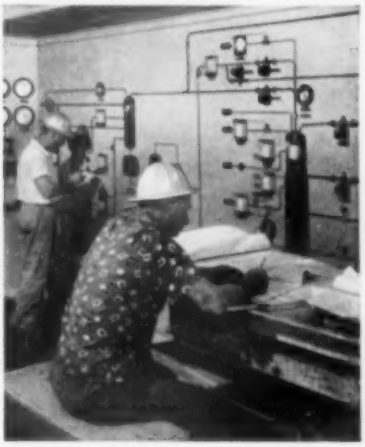
New Alloy Gate Valves Have Split-Wedge Disc Construction

. . . to reduce the force required for tight seating, reduce seat wear, prevent galling of seating surfaces, and eliminate disc chattering. The split-wedge disc is made of two identical, circular discs placed back-to-back in a carrier. The discs have a convex trunnion on the back and an integral circumferential flange which bears on guide slots in the valve body, distributing the seating load uniformly over both discs. Valves are available in 18-8 Mo stainless steel and high-nickel, high-chromium stainless steel. Teflon packing is used in all valves. Sizes ½ to 2-in. inclusive are available in screwed ends, and sizes ½ to 6-in. inclusive in flanged ends. Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

Circle No. **14** *on Reply Card*

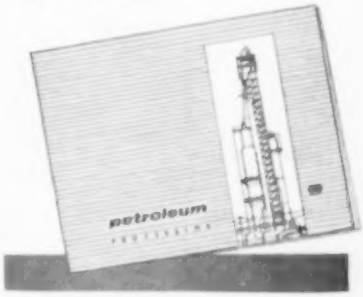
Capsule Case History:





Process Stability with Operating Flexibility was provided when an additional 18,000 BPD cat-cracker was added to a Southwest refinery recently by Kaiser Engineers. The use of the KE-designed panel put the entire operation under the centralized supervision of three men. This example of automation in action is typical of the flexibility which is available to your firm through the services of Kaiser Engineers. An early call to the KE team of petroleum specialists is the first step in providing the best in low cost design and construction of your next petroleum or petrochemical project.

Write for the new KE petroleum processing brochure No. 103.



B.O.F.

***B**uilt-in **O**perational **F**lexibility (outstanding characteristic of the helicopter) is an "extra" found in every plant designed and built by Kaiser Engineers. Not hidebound by tradition, the fresh approach of the KE team of specialists assures you that your next plant will feature efficient and flexible operation at low cost.*

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Get a demonstration of this *precision* method of rolling perfectly bonded tube joints! The AIRETOOL Tube Expansion Control System rolls expanded joints in *half the time* normally required . . . it makes joints tight and leak-proof every time with no rerolling . . . it eliminates over-expansion and distortion of tubes. Simply set the control and go to work —it's entirely automatic.

Ideal for maintenance and production use, the AIRETOOL Tube Expansion Control System speeds fabrication of condenser and heat exchanger bundles . . . it cuts costs . . . boosts output. Contact your nearest AIRETOOL representative for a convincing demonstration.

WRITE for full details and information on AIRETOOL tube maintenance equipment suited to your particular needs.

AIRETOOL
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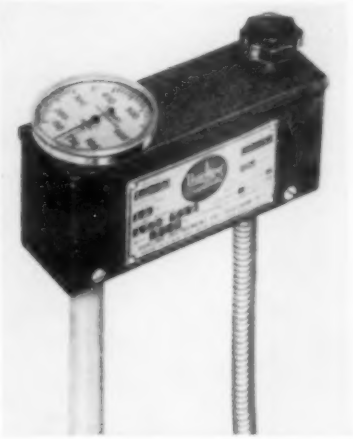
Representatives in principal cities of U.S.A., Canada, Mexico, South America, England and Japan

BRANCH OFFICES: New York, Chicago, Philadelphia, Tulsa, Houston, Baton Rouge



New Temperature Control Has Independent Dial Indicator

. . . and is designed for both laboratory and industrial use. Several adjustable ranges are available, including 150 to 750° F. Control is by the differential expansion of two concentric tubes actuating a snap-action switch through a lever. The switch is rated at 15 amp, 125-250 volts, a.c. Operating differentials are from ± 1° to ± 4° F., depending on conditions. Made for local mounting, the control may be furnished with flange or threaded fittings. The tube is of brass or stainless steel, ⅝-in. O.D. by 14 in. long. Instrument head measurement is 5 in. by 1¾ in. by 2½ in., exclusive of knob and thermometer dial. Burling Instrument Co., 16 River Road, Chatham, N. J.

Circle No. **15** *on Reply Card*

Carbon Residue Apparatus Meets Latest ASTM Specifications

. . . and is designed to determine the amount of carbon residue left after evaporation and pyrolysis of an oil.

Norton materials for high temperature processing

Temperature range of Norton electric furnace materials

C° Melting Point	Temperature of Electric Arc Furnace 4000° C – 7230° F	F° Melting Point
3540	ZIRCONIUM CARBIDE ZrC	6400
3300	FUSED THORIA ThO_2	5970
3140	TITANIUM CARBIDE TiC	5680
3060	ZIRCONIUM BORIDE† ZrB_2	5540
3000	BORON NITRIDE BN	5430
2900	TITANIUM BORIDE† TiB_2	5250
2700	FUSED ZIRCONIA ZrO_2	4900
2620	MAGNORITE* Fused Magnesia MgO	4750
2450	NORBIDE* Boron Carbide B_4C	4440
2300	CRYSTOLON* Silicon Carbide SiC	4170
2000	38 ALUNDUM* Aluminum Oxide Al_2O_3	3630
1900	REGULAR ALUNDUM Aluminum Oxide Al_2O_3	3450

Not True Color Temperatures

†Experimental Materials

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

Are You Stymied by a "High Temperature Barrier?"

Are you concerned with industrial processing involving temperatures ranging upwards to 4000° C? If so, Norton Company has developed and is continually improving materials — produced and purified in electric arc and high temperature resistance furnaces — which may help you solve difficult technical problems. Norton Company supplies these materials in crude, processed or fabricated form — and will work with you in engineering them to your requirements. For further information, write to NORTON COMPANY, Refractories Division, 262 New Bond Street, Worcester 6, Mass.

Making better products . . . to make other products better

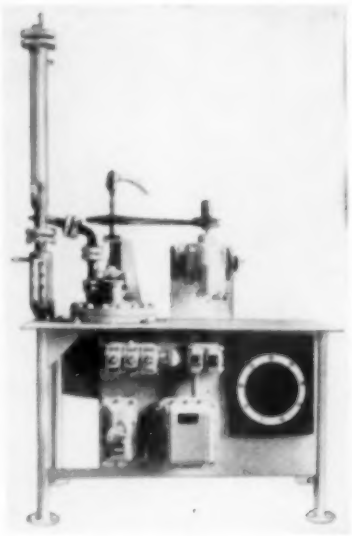
NORTON
REFRACTORIES

Engineered . . . Rx . . . Prescribed

(To obtain more data on advertised products see page 404)

It is used in petroleum refinery laboratories, as well as by processors, automotive lubricants laboratories, diesel laboratories, etc. Test temperatures can be held to within ±5° F. by means of a stainless steel control bulb and an accurate pyrometric temperature controller. A solid cast-iron block has accommodations for five Ramsbottom bulbs and forms the heating chamber which is imbedded in a heavy blanket of thermal insulation. NOTE: The picture illustrating this item is correct. However, the same picture was used incorrectly in February, p. 271, Item No. 13. Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill.

Circle No. **16** *on Reply Card*



Reaction-Distillation Pilot Plant Is Compactly Built

. . . for use in testing and studying chemical processing operations. "Model No. 611" consists of a 5-gal. reactor, agitator, condenser and decanter. Features include central gas-injection into the reactor at the source of agitation, flexible condensate flow baffle in the condenser neck to divert condensate flow away from decanter vapor inlet, and additional connections in the reactor head to permit piping modifications. Endothermic or exothermic reactions up to 150 psig can be accommodated. A cooling cylinder is attached to the reactor inner walls. Three 2000 watt, thermostatically controlled, tubular strip heaters are clamped to the reactor outside. Either 120 or 230-volt heating units are available. Controls are furnished for Class I, Group D locations. Reactor

J-M BLAZECRETE speeds refractory repairs...

That's why it pays you to use this hydraulic setting refractory for temperatures to 3000F

REPAIR old refractory linings—or build new ones—quickly and economically with Blazecrete*. For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place.

When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete goes on fast . . . without laborious ramming or tamping. *And Blazecrete linings last.*

Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix . . . can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 60, New York 16, N.Y. In Canada, 199 Bay St., Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

Whether you gun it... *or slap-trowel it...*

Johns-Manville BLAZECRETE

BUILDS BETTER REFRACTORY LININGS

(To obtain more data on advertised products see page 404)

24 ACRES *Cover the World*

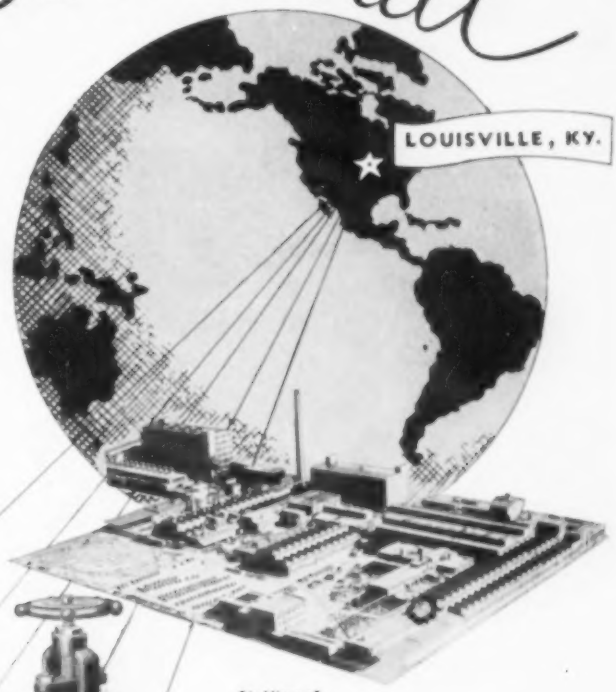
. . . with TOP QUALITY

DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

by

Vogt



Air View of
Henry Vogt Machine Co.

This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

OUR COMPLETE LINE INCLUDES

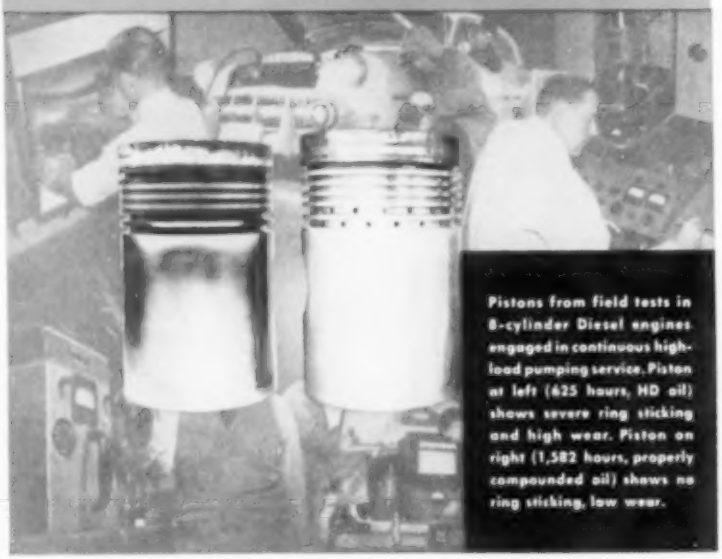
Flanged, Screwed and Socket Weld End Globe, Gate and Check Valves • Ells, Tees and Crosses • Couplings • Bushings • Plugs • Unions • Flanges and Flange Unions • Welding Heads

HENRY VOGT MACHINE CO. LOUISVILLE 10, KY.

Branch Offices: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

(To obtain more data on advertised products see page 404)

Lube Oil Additive performance verified by actual field tests



Pistons from field tests in 8-cylinder Diesel engines engaged in continuous high-load pumping service. Piston at left (625 hours, HD oil) shows severe ring sticking and high wear. Piston on right (1,582 hours, properly compounded oil) shows no ring sticking, low wear.

Ask about Oronite's "custom-formulation" to your needs

There is no substitute for field testing. At Oronite, laboratory engine tests are made to establish compounding levels required for various field conditions. These tests are then correlated with actual field operating conditions to verify performance of the compounded oil.

Oronite specializes in "custom-formulating" additives to your exact needs—meeting your price and performance specifications. Because of Oronite's advanced research program, elaborate testing and manufacturing facilities, Oronite's "custom-compounding" packs more into your oil at a given treating cost.

Why not talk over your problems with an Oronite additive specialist. Contact our office nearest you.

With Oronite Additives you can formulate oils to meet the new A.P.I. Service Classifications and can meet specifications for 2-104-B, MIL-6-2104, Supplement I and Series 2 oils.

OTHER ORONITE PRODUCTS

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714 W. Olympic Blvd., Los Angeles 15, California
Mercantile Securities Building, Dallas 1, Texas

ORONITE CHEMICAL COMPANY

surfaces contacting reacting materials are stainless steel. The small turbine agitator is driven by a ⅓ hp single-phase explosion-proof motor at speeds of 227 to 650 rpm. The condenser is of shell-and-tube type, and the decanter-receiver has a 1½-qt. capacity. The recording temperature controller is air controlled and thermocouple-actuated. Patterson-Kelley Co., East Stroudsburg, Pa.

Circle No. **17** *on Reply Card*

Free Trade Literature

Water Demineralizing Methods

. . . by cation and anion exchange: 39-page *Handbook on Demineralizing* covers history of water treatment, definition of terms, comparison with evaporation, mechanical equipment details, exchange materials, different demineralizer and decarbonator arrangements, case histories, and photographs of actual plants. Cochrane Corp., 17th St. below Allegheny Ave., Philadelphia 32, Pa.

Circle No. **18** *on Reply Card*

Automation Defined

. . . for the technical terms most broadly used: *Automation Dictionary* covers some 87 words and phrases, typical to automatic control, in simple terms. Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Wayne and Windrim Sts., Philadelphia, Pa.

Circle No. **19** *on Reply Card*

Selection and Use of Tubing

. . . made of stainless steel, nickel and nickel alloys, carbon and alloy steels, beryllium copper, and titanium: *Bulletin 40* covers tubing specifications, analyses, and applications for 46 principle types as well as six alloys primarily used for glass-to-metal seals. Superior Tube Co., Norristown, Pa.

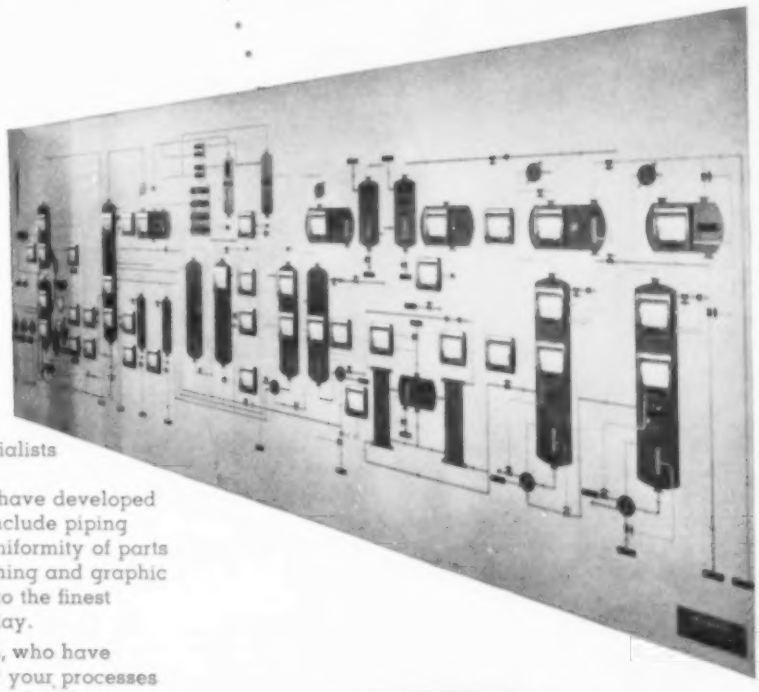
Circle No. **20** *on Reply Card*

Digital Converters

. . . for the electro-mechanical conversion of voltages from the measurement of temperature, pressure, weight, level, etc. into digits: *Catalog 58-10* gives basic description of the "Digi-Coder" analogue to digital converter, types available, operation, specifications, characteristics, and other information. Fischer & Porter Co., 302 Jacksonville Rd., Hatboro, Pa.

Circle No. **21** *on Reply Card*

engineered GRAPHIC PANELS by FOXBORO



Working as a team, Foxboro Panel and Process Control Engineers offer you an unequalled resource . . . one which will assure you of the most efficient instrumentation, and the most practical panel layout, for your process.

Foxboro Panel Engineers are specialists in panel design and fabrication. Exclusive techniques which they have developed over many years of experience include piping arrangements, wiring methods, uniformity of parts and accessories, methods of finishing and graphic portrayal — all of which add up to the finest graphic panel work available today.

Foxboro Process Control Engineers, who have specified the right instruments for your processes over the years, are applying this valuable experience to the integrated control systems which you require today.

Whether we originate the graphic layout from your flow sheet, or work directly from a design of your own, this engineering teamwork will provide you with the ultimate in an operating panel for centralized process control.

If you are planning a new or modernized control room, let us detail a proposal for you, with comprehensive data on Foxboro Graphic Panels.

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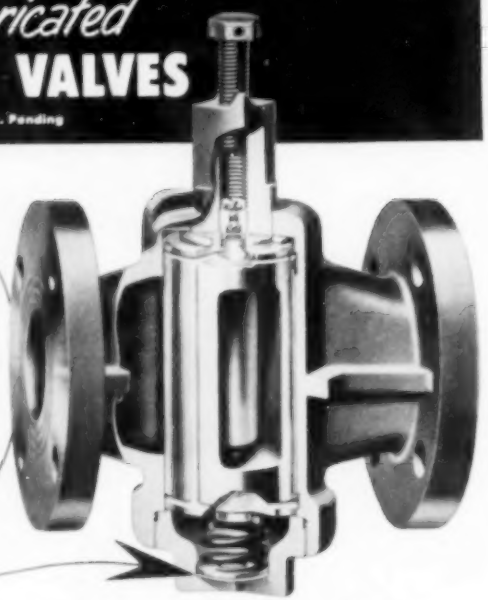
PROCESS CONTROL ENGINEERING

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

No. 4* of . . .

12 REASONS WHY
YOU SHOULD BUY AND USE
LOW-PRICED

HOMESTEAD
Lubricated
PLUG VALVES
Pat. Pending



* SPRING TORSIONAL STRESS RELIEVED BY TEFLON WASHER

Low friction Teflon washer permits spring to turn with plug. This means that less maintenance and longer life are assured, because the spring is subjected to compression only.

This is only one reason why you should **BUY AND USE,** low priced **HOMESTEAD LUBRICATED PLUG VALVES.**

HERE ARE ALL TWELVE

1. Reinforced Teflon packing ring.
2. Completely controlled high pressure lubricant system.
3. 100% pipe area and venturi patterns.
4. No spring torsional stress.
5. No mechanical adjustments.
6. Two lubricants handle most services.
7. Extremely close tolerance between sealing surfaces.
8. Triple head-seal with Lubricant and Teflon packing ring.
9. Plug floated on Teflon surfaces.
10. Leak-proof, double-ball-and-lubricant-sealed check valve.
11. Full-threaded screw assures clean lubricant.
12. Extruded lubricant shows a full protecting system.

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HOMESTEAD VALVE MANUFACTURING COMPANY
"Serving Since 1892"

P. O. BOX 43 CORAOPOLIS, PA.

What's New!

Vertical Process Pumps

. . . for water, alkaline liquids, hydrocarbons, volatile liquids, and other process liquids: 16-page *Bulletin No. B-505* discusses design details and materials of construction for capacities from 30 to 40,000 gpm and heads up to 1000 ft. Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Ave. 26, Los Angeles 31, Calif.

Circle No. **22** *on Reply Card*

Scaled Plant Models

. . . for process and other industries: *Models for Production Lines* describes uses and cost of scale models for machine shops, assembly lines, office layout, etc. Industrial Models, Inc., 2311 Sconset Rd., Wilmington 3, Del.

Circle No. **23** *on Reply Card*

Sarnia Refinery Features

. . . for the 15,000 b/d plant with three reactors in catalytic reforming unit, underground salt caverns for light hydrocarbon storage and a single control building: *Crane Valve World, No. 3, 1954* gives pictures of the Sun Oil Co., Sarnia, Ontario refinery and other articles. Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

Circle No. **24** *on Reply Card*

Odorant Injection in Natural Gas

. . . pipelines using a controlled volume pump in an automatic control system: *Data Sheet E-54-7* states the problem and solution, discussing equipment and the control system flow diagram. Milton Roy Co., Station 2A, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

Circle No. **25** *on Reply Card*

Sodium Phosphates Data

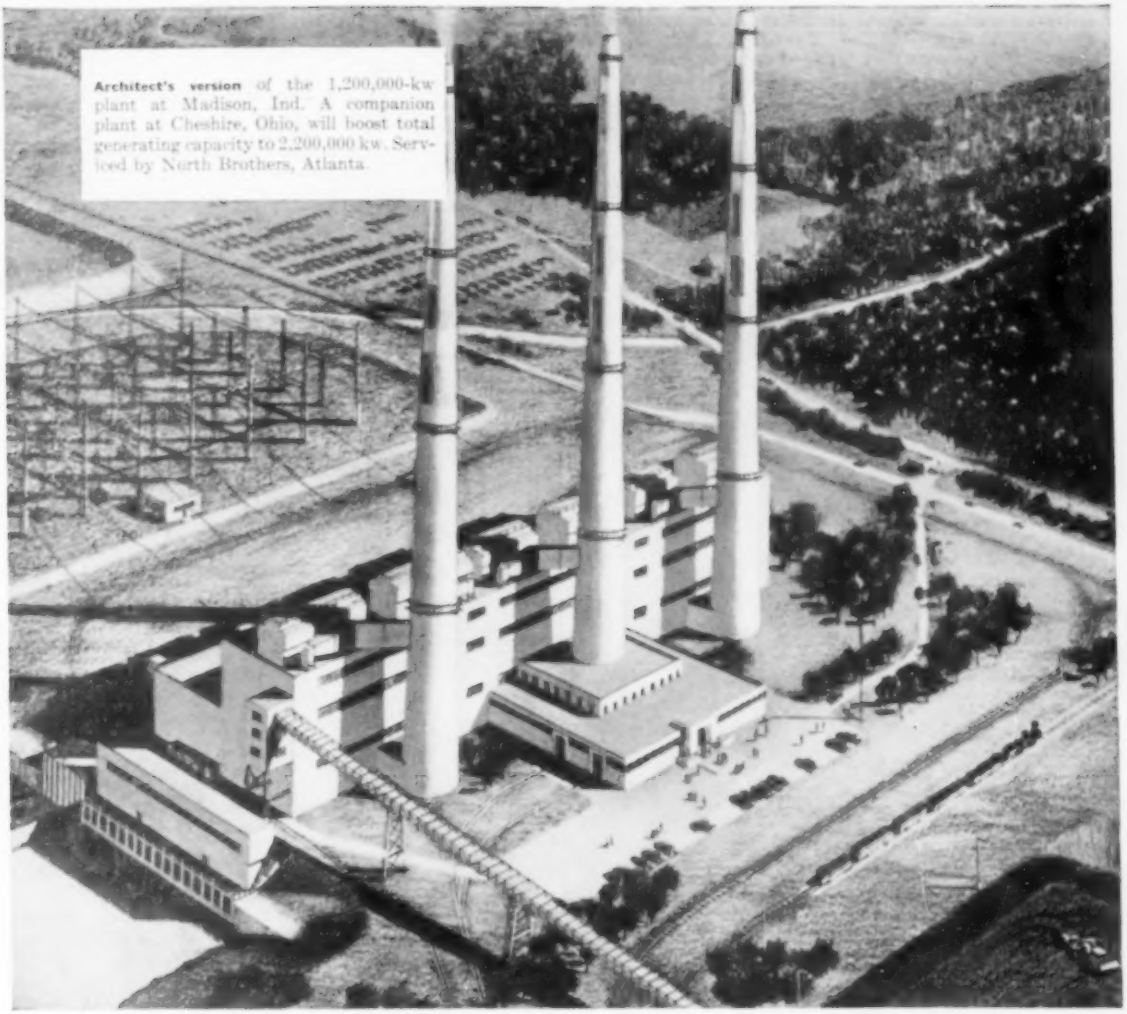
. . . for industrial use: 36-page catalog gives general information, properties and applications with graphs and tables. Monsanto Chemical Co., Inorganic Chemicals Div., St. Louis 1, Mo.

Circle No. **26** *on Reply Card*

Employee Training Handbook

. . . for both plant and supervisory personnel: *How to Train, No. 4* considers the problem of training, when, what and who to teach, methods, steps in training, etc. Wheeler Associates, Inc., 15017 Detroit Ave., Cleveland 7, Ohio.

Circle No. **27** *on Reply Card*



Architect's version of the 1,200,000-kw plant at Madison, Ind. A companion plant at Cheshire, Ohio, will boost total generating capacity to 2,200,000 kw. Serviced by North Brothers, Atlanta.

PICKED FOR TOP ELECTRIC PROJECT

Fiberglas and Kaylo selected for $4,000,000 power insulation contract

Fiberglas® and Kaylo® insulations will contribute importantly to the efficient, economical functioning of two tremendous steam-electric power plants being built by the Ohio Valley Electric Corporation. OVEC was organized by 15 private electric utilities to provide the full electric requirements of the Atomic Energy Commission's new diffusion plant near Portsmouth, Ohio—power which will come from the 1,200,000-kw Clifty Creek Plant at Madison, Ind., and the 1,000,000-kw Kyger Creek Plant at Cheshire, Ohio. This $4-million insulation contract is thought to be the largest of its kind in electric utility industry history.

Fiberglas and Kaylo are outstanding in thermal efficiency—exceptionally strong, moisture-resistant, dimensionally stable, light in weight, easy to apply. They can even be re-used after removal for inspection. Together, they offer the most complete and versatile line of plant insulations available, ranging from lowest sub-zero to 1200° F. (Kaylo is now distributed by Owens-Corning Fiberglas Corp. Available in quantity.)

For full technical data, refer to Sweet's File, Chemical Engineering Catalog or Refinery Catalog—or write direct to Owens-Corning Fiberglas Corporation, Dept. 185-C, Toledo 1, Ohio.

OWENS-CORNING
FIBERGLAS

*T. M. Reg. Owens-Corning Fiberglas Corporation

(To obtain more data on advertised products see page 404)

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Circle No. 40 on the Reader's Service card in this issue (you'll find it between pages 404 and 405), fill in your name and address, and drop the card in the mail. We'll do the rest.

—The Editors

TENNESSEE'S
SO2
Liquid Sulphur Dioxide
The Highly Efficient, Inexpensive
SOLVENT!
Liquid Sulphur Dioxide is particularly suitable as a solvent for recovery of aromatics. It is completely miscible with aromatic hydrocarbons over a very wide temperature range, while the solubility of naphthene and paraffin hydrocarbons is limited and decreases with decreasing temperature. Recovery of a higher percentage of aromatics is obtained for hydrocarbons over a wide boiling range.
Tennessee's highest quality Liquid Sulphur Dioxide can be effectively and economically applied to your operation. We would welcome the opportunity of discussing this with you.
SULPHUR-DIOXIDE
HIGHEST QUALITY
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CONTAINERS: Cylinders, Ton Drums, Tank Trucks and Tank Cars.
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617-29 Grant Building, Atlanta, Georgia

What's New!

Government Patents Released

. . . by the Atomic Energy Commission for non-exclusive, royalty-free use by the public: *Twenty-one Patents Released for Public Use by the United States Atomic Energy Commission* gives patent number, title, inventor and abstract for vacuum pumping, leak detection, pressure measurement, liquid sampling, pyrometry, remote-control manipulation, etc. Chief, Patent Branch, Office of the General Counsel, U. S. Atomic Energy Commission, Washington 25, D. C.

Circle No. **28** *on Reply Card*

Technical Research Service

. . . for petroleum, chemical and other fields of industry: *Battelle Research* describes contract research, operations performed, personnel and facilities available, examples of past research problems conducted, and companies having used this service. Battelle Memorial Institute, Columbus 1, Ohio.

Circle No. **29** *on Reply Card*

Fuel Oil Burner

. . . claimed to save up to 50% on fuel by a combination of superheated steam atomization, pressure, catalytic actions and vacuum: bulletin on the *Hydro Vacuum Burner* illustrates and describes burner operation, and gives engineering facts, ASME test results, and an actual installation. Utah Hydro Corp., Salt Lake City, Utah.

Circle No. **30** *on Reply Card*

Valve and Fitting Catalog

. . . for the oil industry: 85-page catalog, *Milvaco Valves and Fittings* describes all sizes and types of hose nozzle valves, check valves, manifold valves, flanges, couplings, etc., with sections on renewal parts and prices. Registration card keeps catalog up to date obtained from the Milwaukee Valve Co., 2375 S. Burrell St., Milwaukee 7, Wisc.

Circle No. **31** *on Reply Card*

Acrylonitrile Derivatives Data

. . . recommended for evaluation as intermediates for complex organic chemicals and preservatives: *Technical Data Sheets* discuss beta-chloropropionitrile, beta - chloropropionic acid, beta-beta'-thiodipropionitrile, and beta - beta' - oxydipropionitrile giving physical and chemical properties and suggested uses. Monsanto Chemical Co., St. Louis 4, Mo.

Circle No. **32** *on Reply Card*

Look Ahead When You Specify Steam Traps...

100 or 1,000 or 10,000 steam traps in a plant are a small item in relation to the processing equipment that depends upon them. But if they are troublesome, headaches are just multiplied by the number in use. It hardly pays, then, to be pennywise in specifying traps.

Perhaps the biggest single consideration in choice of traps should be their long-range performance. Look ahead—will the traps do the job? Will they stand up? Will they require frequent maintenance?

No traps in the world have ever turned in better performance records than Armstrongs. And, here is why:

Design—simple...only two moving parts . . . "frictionless" free-floating leverage . . . heavily reinforced for wear . . . generous safety margins.

Materials—file-hard chrome steel valve and seat, hardened, ground and lapped together. All other parts corrosion-resistant stainless.

Experience—designed and built by men with more inverted bucket trap experience than any other organization.

Inspection—quality control is not by sampling—*every trap* is tested before shipment.

Guarantee—satisfaction or your money back.

When you specify Armstrong traps you can look ahead to long, long trap life with infrequent maintenance. Ask your Armstrong Representative to give you details or write:

ARMSTRONG MACHINE WORKS
826 Maple Street, Three Rivers, Michigan

Application Engineered

ARMSTRONG STEAM TRAPS

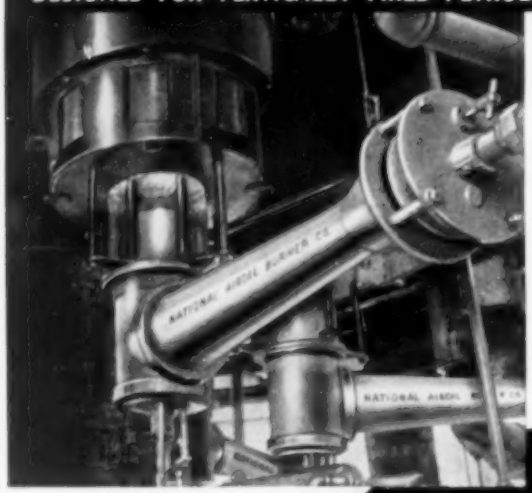
ASK FOR STEAM TRAP BOOK

. . . 44 pages of practical data designed to give you better trapping. Free on request . . . no obligation.

S79

(To obtain more data on advertised products see page 404)

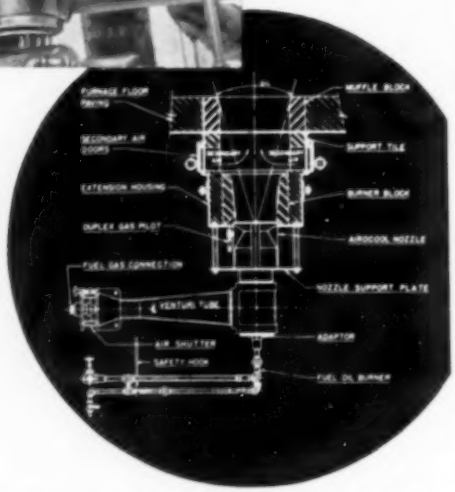
DESIGNED FOR VERTICALLY FIRED PETROLEUM HEATERS



NATIONAL AIROIL

VERTICAL

Oil-Gas Tandem Combustion Units



many more hours on stream, without forced shutdown

Exclusively for vertical firing, National Airoil VERTICAL C-P Tandem Block Units retain all the features of our regular well-known Tandem Units . . . plus: special pre-cast refractory shapes for easier installation and maintenance; secondary air louvres for positive control of flame pattern; and an all steel duplex detaching gear which enables swift, easy, oil burner removal.

VERTICAL C-P Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Blocks allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

ALL VERTICAL Tandem Units are fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . have a high turn down ratio with steady flames . . . maintain high flame temperatures using either fuel oil or gas. With the C-P TANDEM UNIT's clean flame, a cold furnace can be brought to full capacity in a shorter time.

"Many, many more hours on stream, without forced shutdown" . . . yes, YOU will realize high profits from YOUR heaters when National Airoil C-P VERTICAL Tandem Units are specified. Our new folder 498 is yours for the asking.

NATIONAL AIROIL BURNER CO., INC.

CHEMICAL-PETROLEUM DIVISION
1297 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.
Southwestern Division: 2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

What's New!

Valves for Abrasives

. . . and other refinery and oil field applications: *Condensed Catalog 105* is cross-indexed with dimensions and illustrations for stop-check valves, globe and angle stop valves, pressure seal design, angle univalves, small size globe valves for chain or extension operation in vertical lines, and valves for abrasive service. Edward Valves, Inc., 1201 W. 145th St., East Chicago, Ind.

Circle No. **33** *on Reply Card*

Bombing Attack Preparation

. . . to be taken by business and industry: *Job for Management* contains suggestions for continuity of production and management in event of attack, sabotage or natural disaster, prepared by special industry task group. U. S. Department of Commerce, Business and Defense Service Administration, Washington 26, D. C.

Circle No. **34** *on Reply Card*

Coating for Sour Crude Tanks

. . . is inorganic silicate fused to ferrous metals at 900° to 1200° F. for a corrosion resistant and durable vitreous coating: *The Porcenells* discusses development of the coating, method of application, comparisons to porcelain enamel, galvanized zinc and paint, and advantages. Allied Porcenell, Inc., 851 S. Market St., Waukegan, Ill.

Circle No. **35** *on Reply Card*

Light Hydrocarbon Gas Analysis

. . . by the adsorption fractionation method: 12-page *Booklet 82* explains method, gives drawings and flow diagram, and examples of actual analyses claimed to be two to three times faster than any other method for gasoline plant gases and liquids, refinery gases, cycling plant gases, LPG, synthetic rubber intermediates, petrochemical gases and other light hydrocarbons. Burrell Corp., 2223 Fifth Ave., Pittsburgh 19, Pa.

Circle No. **36** *on Reply Card*

History of Shamrock Oil & Gas

. . . starting with the first lease, through the discovery of gas and oil: *Story of the Shamrock* also discusses company organization, financing and processing history, and gives statistical reviews from 1929 to date. The Shamrock Oil and Gas Corp., First National Bank Bldg., Box 631, Amarillo, Texas.

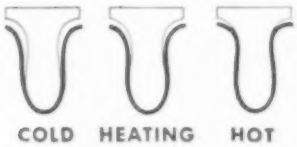
Circle No. **37** *on Reply Card*

Badger

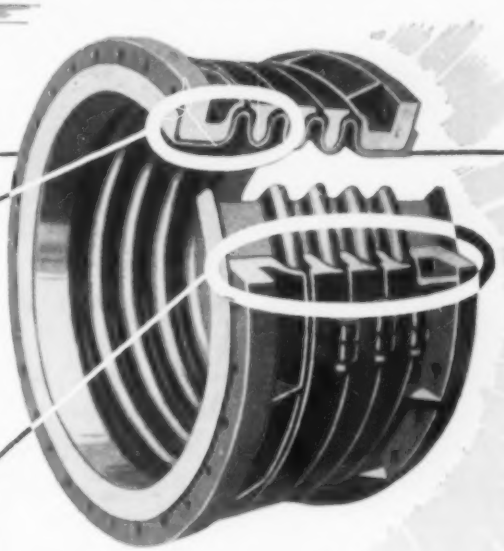
Expansion JOINTS

Typifying Expansion Joint Engineering at its Best

LONG-LIFE FEATURE

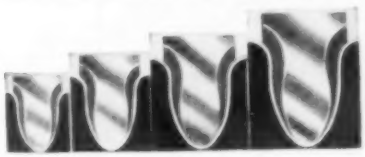


the ALL-CURVE, directed flexing, corrugation.*



LONG-LIFE FEATURE

PROPORTIONAL DEPTH of corrugation for each range of diameters and traverse.**



Badger Directed Flexing Self-Equalizing Expansion Joints give exceptionally long service life, proof of which has been well established in the City of New York where more than 4,000 of these Badger Joints are installed in the underground steam lines of the largest district heating company in the world.

*** The exclusive all-curve directed flexing corrugations and matching equalizing rings distribute the flexing stresses over the entire area of all corrugations.**

**** For each range of diameters there is a carefully calculated depth of corrugation with a defined limit of traverse.**

Each Badger Expansion Joint is originally designed with the proper number and depth of corrugations for maximum flexibility and service life at full rated traverse.

Remember — when you want long trouble free service in your distribution system, there is no substitute for the proper number and depth of corrugations. COMPARE BEFORE YOU BUY and to be sure you get the best, specify "BADGER".

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

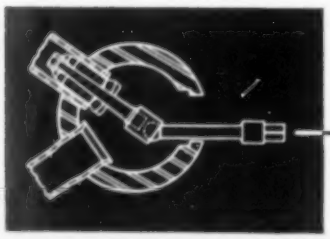
(To obtain more data on advertised products see page 404)

IDEAL

More than sixty years of WIEDEKE Quality

Series 900 Tube Expanders

. . . For rolling and flaring Tubes in Super-heater Headers. Now available for Tubes as small as ⅝" diameter.



Tube Expander, Short Mandrel and Joint Drive pinned together in one compact unit, assures easy entry and withdrawal. SAVES TIME—Expander or Parts will not fall away.

See your Dealer or write us for Bulletin.

THE GUSTAV WIEDEKE COMPANY
DAYTON 1, OHIO

NICHOLSON 'Natural Gas' Traps

- DISCHARGE gasoline and oil from separators, accumulators, after-absorbers, compressor suction lines.
- DRAIN gasoline from scrubber head of compressors.
- DRAIN gasoline and moisture from low places in lines.
- DISCHARGE water from the gas condensate in package and small natural gasoline plants.

To see why these heavy-duty traps are universally recommended, where trouble-free operation is essential, send for Nicholson Trap CATALOG 953.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

215 Oregon Street, Wilkes-Barre, Pa.

What's New!

Oil Burner Control

. . . with automatic operation to proportion oil and air to industrial burners of the two-air connection type: *Bulletin No. 722* discusses the regulator valve designs, capacities, operation, dimensions and parts list. Hauck Mfg. Co., 124-136 Tenth St., Brooklyn 15, N. Y.

Circle No. **38** *on Reply Card*

Packaged Liquid Chillers

. . . for industrial and air conditioning application: 15-page *Bulletin C-1100-B52* pictorially and graphically illustrates the chillers, with specifications, dimensions and applications for models from 7½ to 150 hp. Worthington Corp., Harrison, N. J.

Circle No. **39** *on Reply Card*

Petroleum Processing Index

. . . for 1954: including subject and author indexes for all feature articles and regular departments for the 12 issues of this magazine published during the past year. Available now from McGraw-Hill Petroleum Publications, 330 West 42nd St., New York 36, N.Y., or . . .

Circle No. **40** *on Reply Card*

Spur Gear Hoists

. . . with capacities from ¼ to 25 tons in 62 different sizes: *Bulletin YC-YCT* includes pictures, cut-away drawings, descriptions and specifications for standard models and models for specialized applications. Coffing Hoist Co., Danville, Ill.

Circle No. **41** *on Reply Card*

BARRETT automatic
Filling and Crimping Equipment
for handling greases and other viscous fluids.
- No operator required.
- 100% air operated.

Fills, seals, stamps and counts lug cover pails. Output of 15 pails per minute. Write for details on installation to meet your requirements.

BARRETT Manufacturing Co.
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3 grades of Aerocat® FLUID CRACKING CATALYST

for better fluidizing, circulating and attrition characteristics

in any fluid cracking unit

The importance of particle size distribution in catalyst efficiency is reflected in the names and performance of Cyanamid's three new grades of AEROCAT.

Following extensive research into existing fluid cracking unit needs, these grades were developed to cover the entire range of requirements. Now you can readily select the grade best suited to your unit operation and secure a higher degree of catalyst utilization through proper fluidization, circulation and reduced attrition. These grades represent a wide range, identified for your convenience by their Particle Distribution Index.

This is another advance in catalyst development that makes AEROCAT your most economical means to

- high octane yields
- high throughput
- low CO_2/CO ratio in flue gas
- high isobutane yield
- excellent heat, steam and sulfur stability

– all good reasons why 8 out of 10 users of synthetic catalyst specify AEROCAT Fluid Cracking Catalyst.

For details, write for a new technical data sheet "AEROCAT–Particle Size Distribution," or discuss your needs with our Technical Representative.

DESIGNED TO MEET ALL FLUID UNIT NEEDS

Aerocat 50/60 (Light) — for fluid units with low linear gas velocities, adequate dust disengaging space, excellent cyclone and Cottrell efficiency, low bed density needs.

Aerocat 60/70 (Intermediate) — for fluid units with moderate to high linear gas velocities, adequate catalyst recovery equipment.

Aerocat 75/85 (Narrow) — for fluid units with high linear gas velocities, moderate disengaging space, limited recovery equipment.

In Canada: North American Cyanamid Limited, Toronto and Montreal

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MORE THAN 58 YEARS OF SERVICE
WORLD'S MANUFACTURER OF THE MOST COMPLETE LINE OF FLOOR MAINTENANCE EQUIPMENT

What's New!

High & Low Pressure Strainers

. . . for oil, water, steam, and chemicals: 16-page *SK Bulletin 9-S* contains dimension and sizing charts, sectional drawings, applications, design features, and specific operating characteristics for 14 types available from a wide variety of materials. Schutte and Koerting Co., Dept. HT-A, Cornwells Heights, Bucks Co., Pa.

Circle No. **42** *on Reply Card*

Steam Jet Vacuum Equipment

. . . including syphons, heaters, and gas pumps for high vacuum applications without moving parts: *Bulletins 2-A, 3-A, and 5-E* discuss applications, construction, operation, performance data, sizing tables, and operating instructions for use in filtration, distillation, mixing, heating, vacuum transfer and other operations. Schutte and Koerting Co., Dept. J-P, Cornwells Heights, Bucks County, Pa.

Circle No. **43** *on Reply Card*

Liquid Waste Treating

. . . equipment including clarifiers, digesters, and automatic backwash sand filters: *Bulletin No. 35-D* discusses applications, specifications, and illustrates construction principles. Hardinge Co., Inc., 240 Arch St., York, Pa.

Circle No. **44** *on Reply Card*

Malleable Couplings & Fittings

. . . for savings of time and labor for piping in the petroleum and other industries: *Form CF 1054-10* shows applications, specifications, how to use, and dimensions. Gustin-Bacon Mfg. Co., 210 W. Tenth St., Kansas City 6, Mo.

Circle No. **45** *on Reply Card*

Water Deaerating & Heating

. . . unit which operates from 1% to 100% of rated capacity removing residual non-condensible gases and reducing dissolved oxygen to less than 0.005 ml/l: *Bulletin 3677* discusses construction, operation, and application. The Permutit Co., 330 W. 42nd St., New York 36, N. Y.

Circle No. **46** *on Reply Card*

Pneumatic Transmitter

. . . for measuring flow, level, differential pressures, and low pressure industrial service: *Sup. Bulletin 285-L2* contains installation diagrams, dimensions, uses, and operation of the "BalanCel" which operates on the

SIX DAYS OF DOWNTIME SAVED

Refinery tower cleaned chemically by Dowell in only eight hours . . . a six-day saving over mechanical methods!

A refinery operator had to shut down his H_2S stripper bubble cap tower every two months to remove an oily carbonate scale. Each shutdown took seven days, because of the mechanical cleaning methods used, and even then the tower was not thoroughly cleaned.

Dowell engineers were asked to tackle the problem. They cleaned the tower in just eight hours, using chemical solvents. Visual inspection showed the tower to be free of scale with all loose deposits washed from the caps and trays. The operator of this refinery was so impressed that he adopted a regular schedule of Dowell chemical cleaning.

Dowell chemical cleaning methods are designed to reduce costly downtime, because solvents are introduced through regular connections, keeping dismantling at a minimum. Liquid solvents can go wherever gases or condensates flow —to clean angles, bends and other irregular surfaces inaccessible to mechanical methods.

You can help to maintain maximum operating efficiency in your plant by arranging for a regular program of Dowell chemical cleaning. For full information, call your nearest Dowell office, or write Dowell Incorporated, Tulsa 1, Oklahoma, Department C-32.

chemical cleaning service for industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

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Lightweight
RIDGID
Tristand Pipe Vise 40A
makes your work easier

Extra easy to set up...
built-in folding steel tray pushes up easily to fold legs of Tristand for easy carrying; tray pushes down easily to set up, holds stand solidly rigid.

Handy Work Bench...
extra-strong stand and tray all one unit. Full size vise-base has 3 benders, ceiling brace screw, lots of tool slots, besides handy tool tray. Most for your money—your Supply House has them, can demonstrate and deliver fast!

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

force-balance principle. Builders-Providence, Inc., 345 Harris Ave., Providence, R. I.

Circle No. **47** *on Reply Card*

Did You Miss These?

The following items, reviewed originally in December, have aroused considerable interest among the readers. They are repeated briefly as a service to those who might have missed them the first time they appeared. For details or literature, please use the regular Reply Card in this issue.

New Zeolite Adsorbents Separate Hydrocarbons by Their Size

. . . and have promise of providing a significant progress step in the use of adsorption as a processing technique. Chemically, the "Molecular Sieves" are synthetic zeolites, similar to many natural clays and feldspars. Physically, they are adsorbents which will separate liquids and gaseous materials on the basis of differences in molecular size.

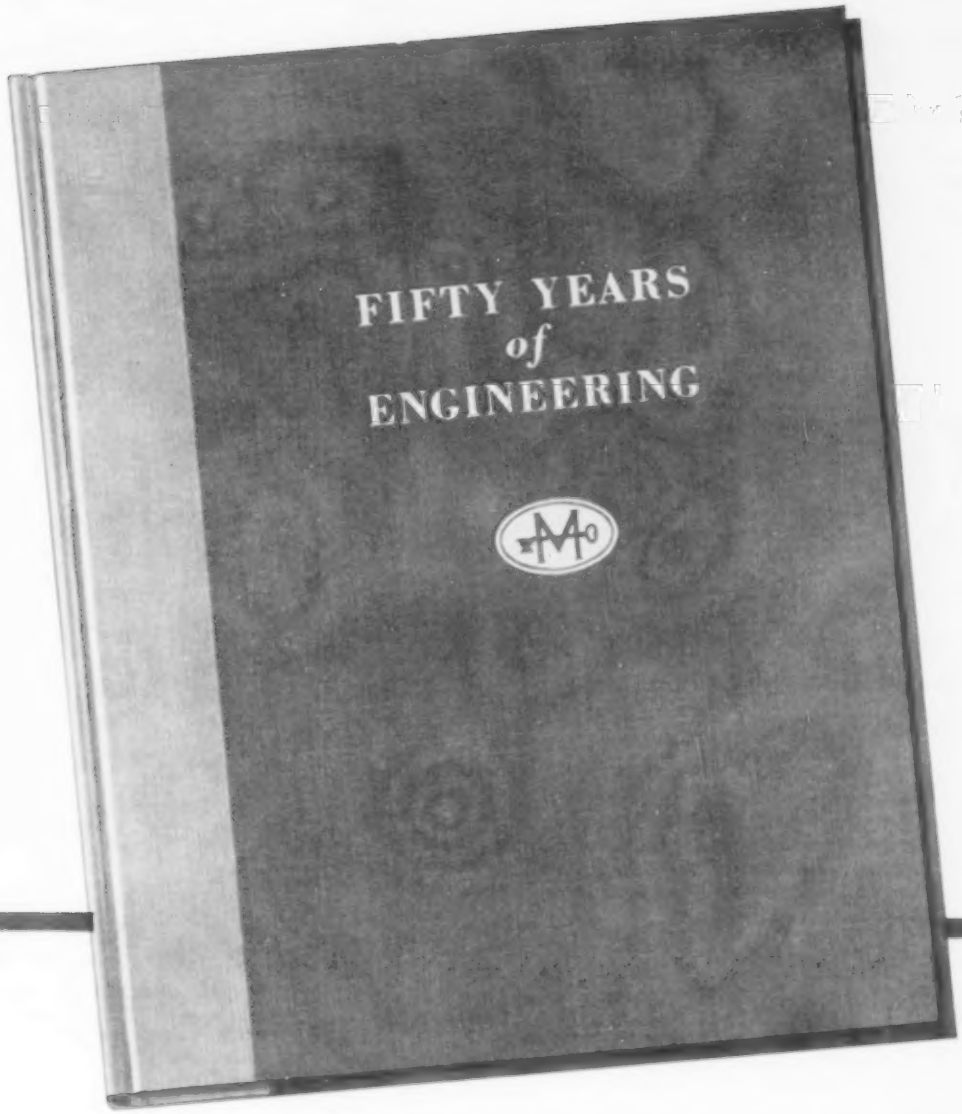
They are made of atoms of sodium or calcium aluminum silicate, arranged in a definite crystalline formation. This structure contains a large number of cavities, interconnected by a number of still smaller holes, or pores. Both cavities and holes are very uniform in size and measurable. During manufacture the water of hydration is driven off, and the crystals retain their form and structure. Straight chain hydrocarbon molecules, having smaller diameters than branched chain molecules, will enter the "sieve" and be trapped, while the larger branched chain molecules cannot enter and pass on with the process stream. Thus, mixtures of compounds with the same boiling points, for example, can be separated (impossible in the case of fractionation).

Typical applications foreseen for the material include: hydrocarbon separation, recovering unsaturates from waste gas streams, gas purification, liquid and gas drying at elevated or normal temperatures, and many others. Linde Air Products Co., 30 East 42nd St., New York 17, N. Y.

Circle No. **48** *on Reply Card*

New Pressure Transmitter Has No Stagnant Pressure Lines

. . . and can measure up to 2500 psig at 300° C. The "P3T Flush Diaphragm" pressure transmitter has the measuring diaphragm mounted in a



THE YEAR 1955 marks the Fiftieth Anniversary of the founding of Arthur G. McKee & Company.

Since 1905 this company has had a continuous, successful record of fifty years of engineering, designing, building in every quarter of the globe—fifty years of accumulating knowledge and experience—fifty years of building an organization with the specialized abilities, the scope and resources to undertake projects of any size in any location.

The sound, practical engineering methods and thorough, painstaking construction techniques developed in a half-century of McKee history can be invaluable to you on your new plant project, as they have been to hundreds of McKee clients in the past.

50th ANNIVERSARY

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Arthur G. McKee & Company • Engineers and Contractors

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British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

"Vaporization Equalibrium Constants And Activity Coefficient Charts"

You can still get a copy of this popular reprint—41 working scale charts (21 equilibrium constant charts for the hydrocarbons from methane to 700°F. boiling point, and 20 activity coefficient charts), plus a description of how to use them. 48 pages, 8½ x 11, paper bound (1949) $1.50

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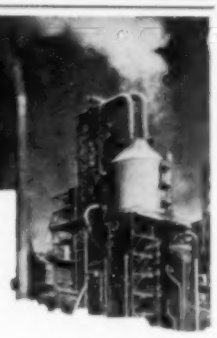
Note: New York City residents add 3% Sales Tax.

"Alamask"



offers a complete and diversified line of reodorants for petroleum and allied products

No longer need the products of the petroleum industry inflict upon their users the obnoxious odors resulting from the mercaptans and sulfides in their processing.

Years of development work and product-testing have culminated in a complete line of Alamask® reodorants that can successfully mask the objectionable odors of many petroleum products. Check this table to see which Alamask reodorants will solve your malodor problems:

"ALAMASK"	GASOLINE FRACTIONS	ASPHALTIC COMPOUNDS	KEROSENE BLENDS	COAL SPRAY OILS	SPACE HEATERS	CUTTING OILS	CLUTCH OILS	DIESEL FUELS	JET FLUIDS	MINERAL SPIRITS	WAXES	NAPHTHA	BURNER OILS
AAM								X					
AO						X	X						
AR		X								X			
BGM		X											
BN						X	X						X
BUL				X	X			X			X		X
CC			X							X			
CE			X							X			
CX											X		
MS			X							X	X	X	X
0.19	X				X	X	X		X				X
0.28	X				X	X	X		X				X
TO									X				

Rhodia's chemists and engineers, experienced in odor abatement and waste disposal, will provide technical assistance to you in your efforts to correct malodors.

For complete information on these new, highly-effective reodorants, write today to Rhodia, Inc., Industrial Reodorants ("Alamask") Division, 230 Park Avenue, New York 17, N. Y.

Rhodia INC.

well with the diaphragm surface flush with the pipe wall inside. All parts in contact with fluids are made from stainless steel. In operation, pressure changes cause small movements of the diaphragm which are transmitted through a rod to a mechanical linkage which in turn actuates the core of a differential transformer. The resulting output signal varies from 0.000 to 0.500 volts, and is directly proportional to the measured pressure. Air lines, slide wires, electric motors, and vacuum tubes are eliminated. The transmitter is continuously adjustable and can be used with recorders in pressure ranges of 0-200 to 0-1000 psig and 0-1000 to 0-2500 psig. Sensitivity is claimed better than 0.005%, reproducibility 0.1%, and accuracy 1.0%. Process fluid temperature change effects on readings are low. The Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio.

Circle No. **49** *on Reply Card*

Catalytic Cracking

. . . applications for fuel oil reduction: *Houdry Pioneer, Vol. 7, No. 1* gives four refinery situations and their solution by "Houdriflow" catalytic cracking with material balances, yield data, and economic comparisons. Houdry Process Corp., 1528 Walnut St., Philadelphia 2, Pa.

Circle No. **50** *on Reply Card*

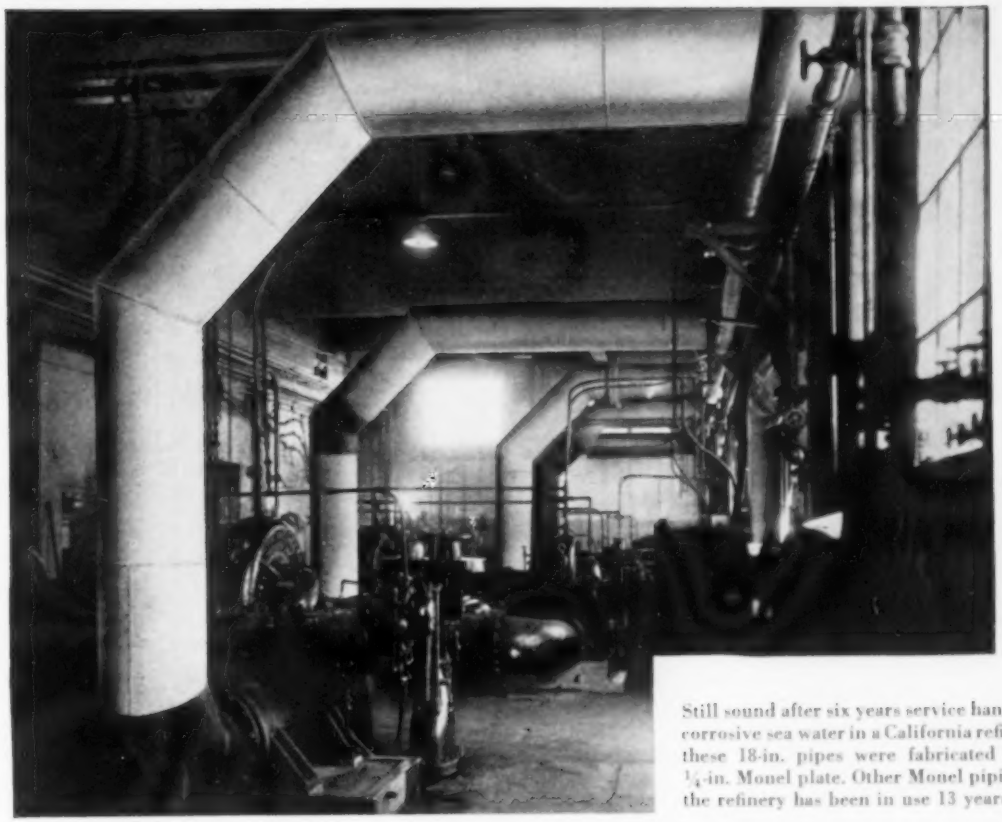
Cooling Tower Tests

. . . require a minimum of apparatus and effort to determine performance: *Technical Bulletin R-54-P-5* tells how to "Test Your Tower," giving procedure and use of performance rating charts. Technical Services Dept., The Marley Co., 222 W. Gregory Blvd., Kansas City, Mo.

Circle No. **51** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of Petroleum Processing to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item. Then fill in the rest of the card and drop it in the mail. No postage is required.



Still sound after six years service handling corrosive sea water in a California refinery, these 18-in. pipes were fabricated from ¼-in. Monel plate. Other Monel piping in the refinery has been in use 13 years.

Makes lightweight pipe to handle sea water out of corrosion-resisting MONEL

California refiner finds Monel offers 4 clear-cut advantages

This pump house takes water from the sea and circulates it through the cooling system of a California refinery.

As the original cast iron pipes wore out they were replaced with the lighter-weight fabricated Monel pipes you see here. Monel was picked over other metals for four sound reasons:

1. Monel offers extremely high resistance to corrosion by sea water.
2. Has high strength-to-weight ratio.
3. Can be obtained in any form (tubing, plate, sheet, rod and castings).
4. Is easy to work with — cuts, forms, welds simply and quickly.

Pipe is just one place where you do well to use Monel for handling salt and brackish water. Monel, cast "S" Monel and heat-treated "K" Monel are being used in many plants and refineries for *longer-lasting* pump shafts and sleeves, condensers, tube sheets, impellers, screens, barometric condensers and other equipment where salt water corrosion is a problem.

If you have a corrosion problem and would like to know whether Monel or one of the other Inco Nickel Alloys can solve it, Inco's Corrosion Engineering Section will be glad to work with you. Just write:

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

INCO **Nickel Alloys**

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • INCONEL®
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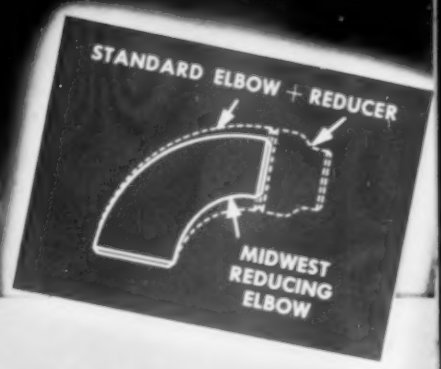
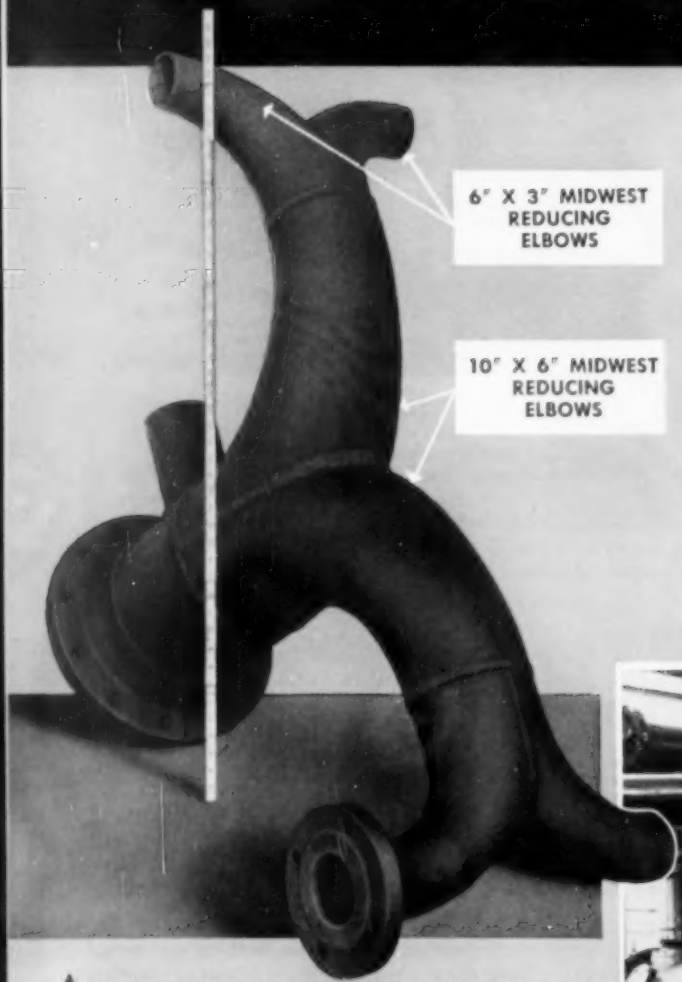
Better Piping at a Better Price

by Using MIDWEST REDUCING ELBOWS



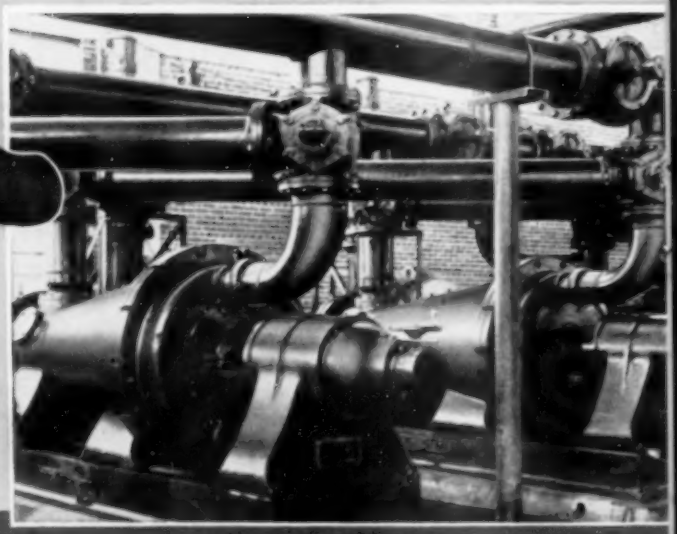


The Midwest Reducing Elbow offers important advantages in both piping design and piping cost. It needs only two welds instead of the three required by a standard elbow and a reducer (see sketch above). There is also a saving in layout time. Turbulence and pressure drop are reduced by the gradual taper . . . less space is needed . . . insulation is easier . . . and piping appearance is improved.

Only Midwest Reducing Elbows are available from stock in sizes to 16" . . . larger on special order. They have the same dimensional accuracy, uniformity of wall thickness, exact included angle and true center-to-end dimensions of Midwest Straight Elbows. For further information, ask for Catalog 54.

699

↑ Midwest Reducing Elbows made it possible to fabricate this transformation piece for a boiler feed suction line so that it could be installed in the limited space available and still get the benefit of streamline flow. There was also a cost saving in comparison with a less efficient and bulky assembly made with straight tees, ells and reducers.



→ Paper stock flows with minimum resistance through Midwest Reducing Elbows from 8" connection on Jordan to 10" header. Other advantages over standard elbow and reducer: a saving in cost and space, and improved appearance.

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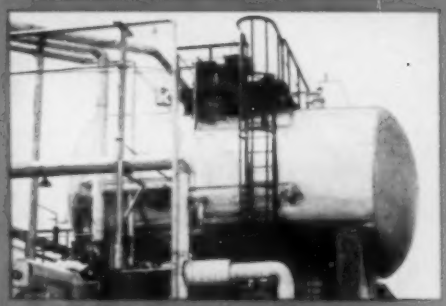
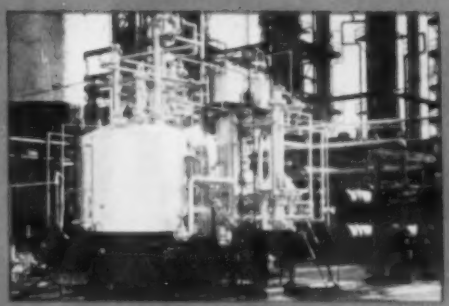
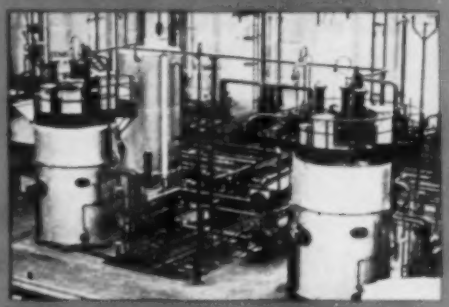
ELECTRIC PROCESSING



Petreco pioneered electric desalting and is the recognized leader in the field. Petreco offers a wide choice of desalting plant design, horizontal, vertical or spherical, all equally efficient.



Petreco distillate treating offers refiners an improved method for acid-contacting, caustic-scrubbing or doctor-treating. This new process is compact, continuous and automatic.



Petreco lube oil treating provides continuous, automatically-controlled acid treatment for lubricating oil and similar stocks. Operating in a closed system, it saves time, acid, space and guesswork.

Petreco deasphaltization removes ash-forming free caustic or sodium naphthenate soaps from heavy fuel stocks, enabling them to be marketed advantageously or used as a cracking charge.

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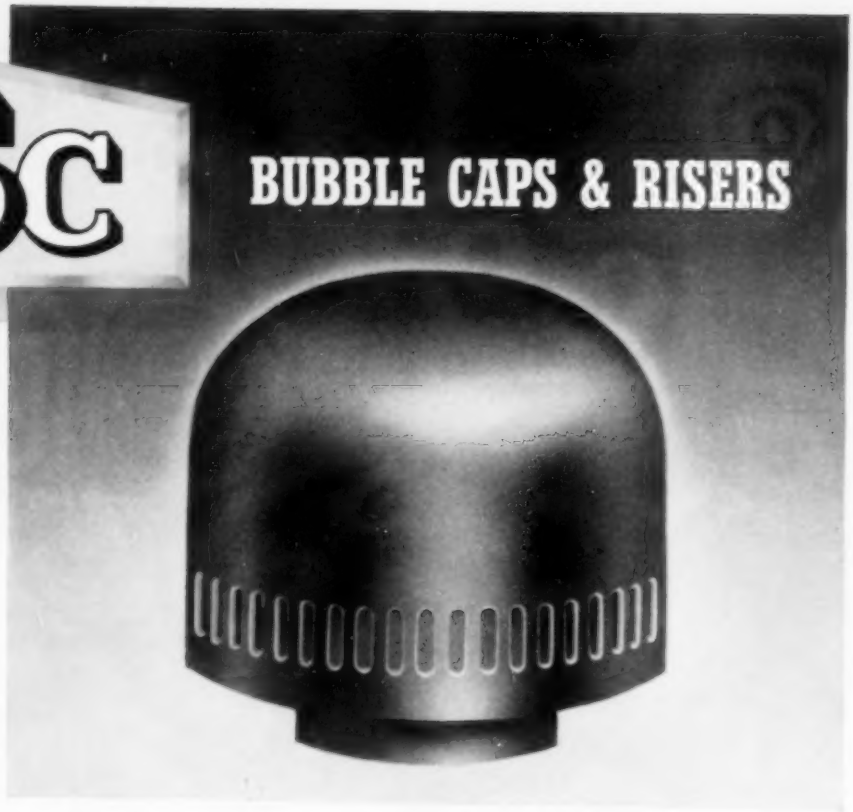

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With dies on hand for 300 standard styles of bubble caps and risers, PSC is saving many customers the cost of dies as well as design and delivery time. For all methods of tray assembly. Complete engineering details on all 300 styles in Catalog 54.

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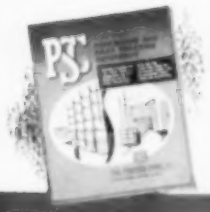
We fabricate caps from any metal which best meets your coking and corrosion conditions: Aluminum, Brass, Copper, Steel, Stainless of any type, Nickel, Monel, Inconel, Ampco Metal. This PSC advantage has effected real maintenance economies for some customers.



Send for Process Equipment Catalog 54

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This, the largest Model IV catalytic cracking unit in the world (design capacity 40,000 BPD), recently went on stream at the Standard Oil Company of California's refinery, here. Processing equipment (fractionation, gas recovery, caustic treating and H_2S removal) are also included in this plant. The cracking section is designed to handle 55,000 BPD of fresh and recycle feed and has a catalyst circulation rate of over 60 tons a minute. Automotive and aviation gasolines are the end products.

The Fluor Corporation, Ltd. performed the process design, mechanical design, procured equipment and materials, and constructed the entire plant. Fluor is ably equipped to handle large-scale engineering and construction projects for the petroleum, gas, chemical, petrochemical and power industries.

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FINANCIAL AID TO HIGHER EDUCATION

Business Aid for Our Colleges—Voluntary or Involuntary?

Previous editorials in this series have shown that:

- As a group the nation's independent, privately endowed colleges and universities are in grave financial trouble, and
- There are many different means by which business firms can extend a helping hand to these institutions.

This editorial, one of a series devoted to the financial problems of higher education, submits this proposition: **If business firms do not voluntarily go to the financial aid of higher education, there is every prospect that they will soon be providing more financial support for higher education involuntarily, through taxation.**

If this prospect materializes, one of the basic elements of a well-balanced system of higher education—a strong array of independent colleges and universities—may well be dangerously weakened if not destroyed. And in the process a potentially crucial bulwark for freedom of enterprise in the United States—that same strong array of independent colleges and universities—will be undermined.

Acceptance of these propositions implies absolutely no disparagement of tax-supported colleges and universities. These have an indispensable role in the total system of higher education in the United States. Leaders of these institutions would be among the first to agree that their position is strengthened by a strong system of independent institutions, supported privately rather than by political agencies.

What is the evidence that in one way or another, voluntarily or involuntarily, business will be giving more financial support to higher education? One impressive part of this evidence is provided by the recent rapid increase in the proportion of college and university students attending tax-supported institutions.

Rapid Shift in Enrollment

In the fall of 1952 tax-supported colleges and universities enrolled about 7.5 per cent more students than the independent institutions. In 1953 this percentage was doubled. And in 1954 the tax-supported institutions enrolled 26 per cent more students.

In the case of students entering college for the first time the relative growth of the tax-supported institutions recently has been even more striking. In 1952, the number of beginning students in the tax-supported schools, as reported by the U. S. Office of Education, exceeded those in the independent colleges and universities by 35 per cent. In 1954, just two years later, this figure jumped to 49 per cent.

Why has the proportion of students attending tax-supported colleges and universities been in-

creasing so rapidly? There are many reasons. But a dominant reason is that, in order to keep going at all, the independent institutions have been forced to make large increases in the prices they charge for instruction. The purchasing power of their endowment funds has been cut in half by price inflation. The capacity of the wealthy to supplement their endowments by gifts, as they have done in the past, has been greatly reduced by high taxes. As a result these schools have been forced to rely increasingly on higher prices for instruction (tuition as it is called in academic circles) to make both ends meet.

Since 1940, the independent colleges and universities have raised their tuition fees by an average of about 60 per cent. This is considerably less than the increase of about 100 per cent in prices generally since 1940. And it is nowhere near enough to prevent the faculty members of the independent colleges from faring miserably in terms of salaries, a matter of major national importance to which we shall return in this series. But the increase in tuition fees of the independent colleges has been much greater than the increase in the fees charged by the tax-supported schools. And that price differential increasingly tends to shunt students into the schools which are supported chiefly by taxes. Independent colleges now charge, on the average, about $580 per year for a full course of instruction while the tax-supported institutions charge, on the average, about $240.

Bigger Tax Bill in Prospect

A large increase in the total enrollment in our colleges and universities during the next decade is in prospect, particularly when the great increase in births during World War II is reflected in the number of young men and women of college age. With a total of 2.5 million students at present enrolled in our institutions of higher learning, it is estimated that the total will be over 3 million by 1960.

If this trend continues most of the anticipated increase in college and university enrollment will be concentrated in tax-supported institutions. Indeed, if the shift toward tax-supported institutions that has occurred in the last three years were to continue over the next six years at the same rate, about two million of the three million students anticipated in 1960 would be in tax-supported colleges and universities and one million in independent schools. In 1950 there was a 50-50 division in enrollment. This shift would mean, of course, a corresponding increase in the tax bill for tax-supported education. And of this bill, we can be sure that an ample share would be assessed against business firms.

No Easy Solution

The best way, of course, to put a brake on a soaring tax bill for higher education is to help the independent institutions get in shape financially to carry a larger share of the student load. For most companies the development of a mutually satisfactory program of financial aid for higher education is a complicated process. In fact, it is so complicated that some companies with an initial disposition to provide financial help are inclined to despair of working out a mutually constructive plan.

If, however, the leaders of business will contemplate seriously the only available alternative to their extending voluntary help to our independent colleges and universities, their determination to work out a plan will be strengthened. For that alternative involves a grave weakening of our system of higher education, together with an involuntary increase in the financial support of higher education by business. The increase would come through higher taxes. Contemplation of such an alternative should, if necessary, toughen the will of business firms generally to do everything possible to extend financial help to our independent colleges and universities.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

EDITORIALS . . .

You'll Pay—One Way or Another

ON THE preceding two pages in this issue you'll find a message of importance to everyone in industry. It discusses the problem of financing higher education in the U. S. and outlines the plight of the independent colleges and universities.

Briefly, the independent schools are finding that inflation has cut the purchasing power of their endowment funds. As a result, tuition charges have had to be increased. As a further result, more students each year are attending tax-supported colleges and universities — where tuition charges average only about $240 a year as against an average of about $580 in private institutions.

What it means is this: One way or the other, you are going to pay for higher education. If you and your company don't do it voluntarily through grants and the like to private schools, you'll do it involuntarily through increased taxes to support more public schools. If the latter course prevails, our well-balanced system of higher education may well be dangerously weakened if not destroyed.

The major oil and chemical companies in this country have recognized their responsibilities in the problem, and have been taking steps to do their part to help solve it. As an example, Standard Oil Co. of N. J. and its affiliates last year contributed a million dollars to support higher education.

It shouldn't be only the Jerseys and Soconys and DuPonts who foot the bill. Every company, large and small, has a stake in the future educational system in this country.

Getting even closer to home, every individual reader of PETROLEUM PROCESSING has his own personal responsibility in the matter. Aside from contributions to your own alma mater, you can see that the proper persons in your firm are aware of the situation.

We sincerely suggest you go back and read the preceding two pages, if you haven't already done so. And if you'd like copies of the earlier two messages in this series on financial aid to higher education we'd be glad to send you reprints.

Policy or Politics on Shale Oil?

FIVE Senators from the Rocky Mountain states have called on Congress to continue operation of the Bureau of Mines' shale oil demonstration plant at Rifle, Colo., despite recommendations from both the Bureau and the National Petroleum Council that it be put on a stand-by basis.

The Senators' request impresses us as being more a selfish political move to foster a new industry in their home states rather than a sound policy for building up our future oil reserves.

Without question there is a large potential supply of shale oil, perhaps 100 billion barrels or more, in the shale beds in the Rocky Mountain area. And at some future date it may be of some importance to our civilian economy and national defense.

But to argue for a government program to develop these reserves now on the grounds of need indicates either woeful ignorance or willful disregard of the facts. Our proven reserves of crude oil today are larger than ever before. Oil producers in this country have shut in over 2,000,000 b/d of production.

The Bureau's research has been highly helpful in setting the ground-work for the eventual development of a commercial shale oil industry.

From now on it's up to private industry to carry on the investigation of shale, and to build commercial plants when economic conditions justify.

That the work will go on is evidenced by the recent announcement of Union Oil Co. of California that it will soon start a $5,000,000 program to develop its own shale reserves.

Competitive research and development by the petroleum companies will establish an oil-from-shale industry, as the time approaches when we need it, much more soundly, quickly and economically than any government-sponsored program.

Rubber Disposal—Well Done Job

THE three men who worked out the disposal of the Government's rubber plants are smart cookies.

They arranged to sell 24 of the 27 facilities, and the deals they worked out will return to the Government $310,565,000. That's 96.6% of the total net cost to the taxpayers of the entire synthetic rubber program since its beginning in 1942, including the cost of the three unsold plants. And the sales price for the plants is nearly double their depreciated book value. There is no doubt that the Disposal Commission secured "full fair value."

Judging from the realignment of the petroleum industry's part in synthetic rubber (which you'll find described in detail in this issue — "The Pattern Changes for Petroleum's Role in Synthetic Rubber," p. 375), the Commission likewise did an effective job of creating a "competitive industry."

What really convinced us that the Disposal Commission members knew what they were doing, however, was a little secret which Mr. Pettibone, Commission chairman, disclosed recently:

"Several bidders have informed us quite fully about the defects of the particular facility for which a bid was submitted. That is a rather human trait which we understand—sympathetically. In addition, several bidders have been at some pains to mention superior advantages of a competitive facility not in their bid. We have listened respectfully to the catalog of defects. We have been even more interested in the advantages assigned a competitive plant. It has seemed to us to be appropriate to mention those advantages to the bidder for the other plant."

The Commission did a splendid job, and deserves the heartfelt thanks of both Government and industry for working out the disposal package.

Look Into
B&A CALCIUM ACETATE

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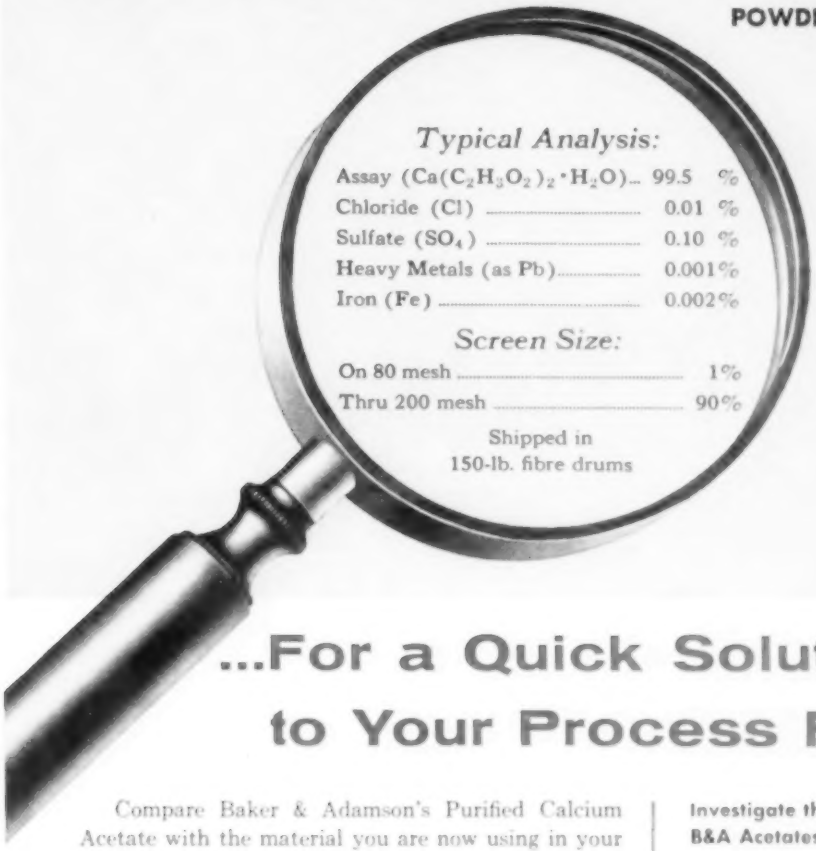

Typical Analysis:

Assay ($Ca(C_2H_3O_2)_2 \cdot H_2O$)	99.5 %
Chloride (Cl)	0.01 %
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So look to Baker & Adamson for all your Acetate and other fine chemical needs. Newly expanded production and distribution facilities assure you stocks at all times. For samples and further information, send in the handy coupon.

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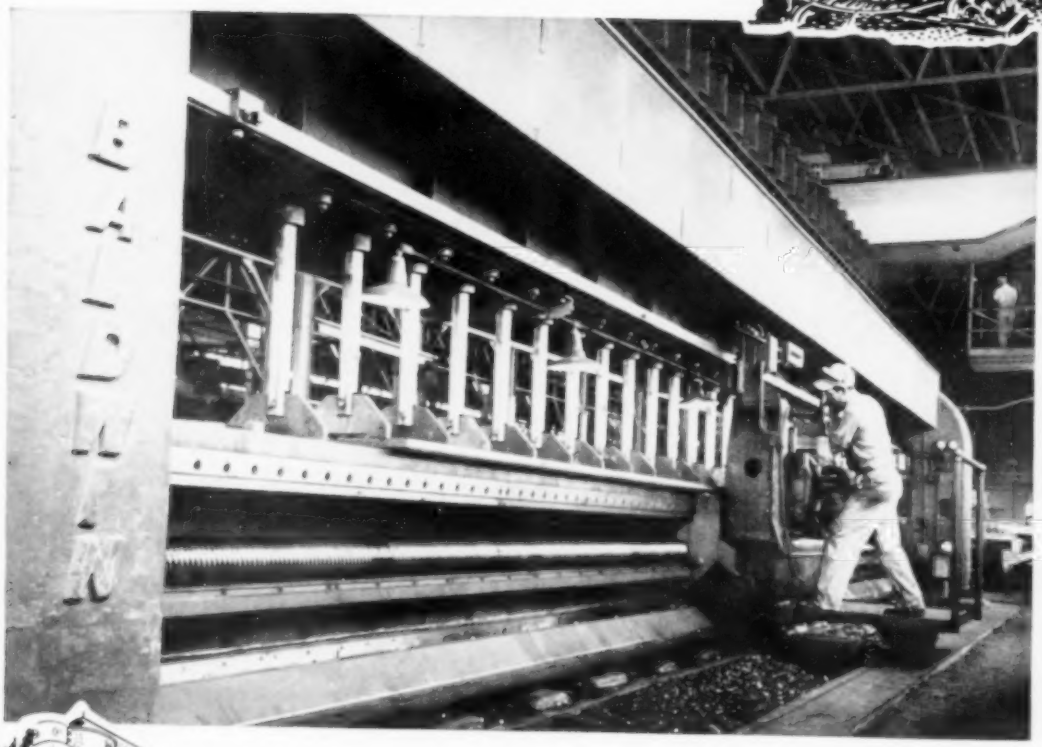

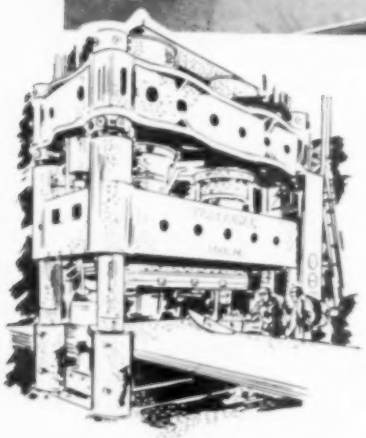

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